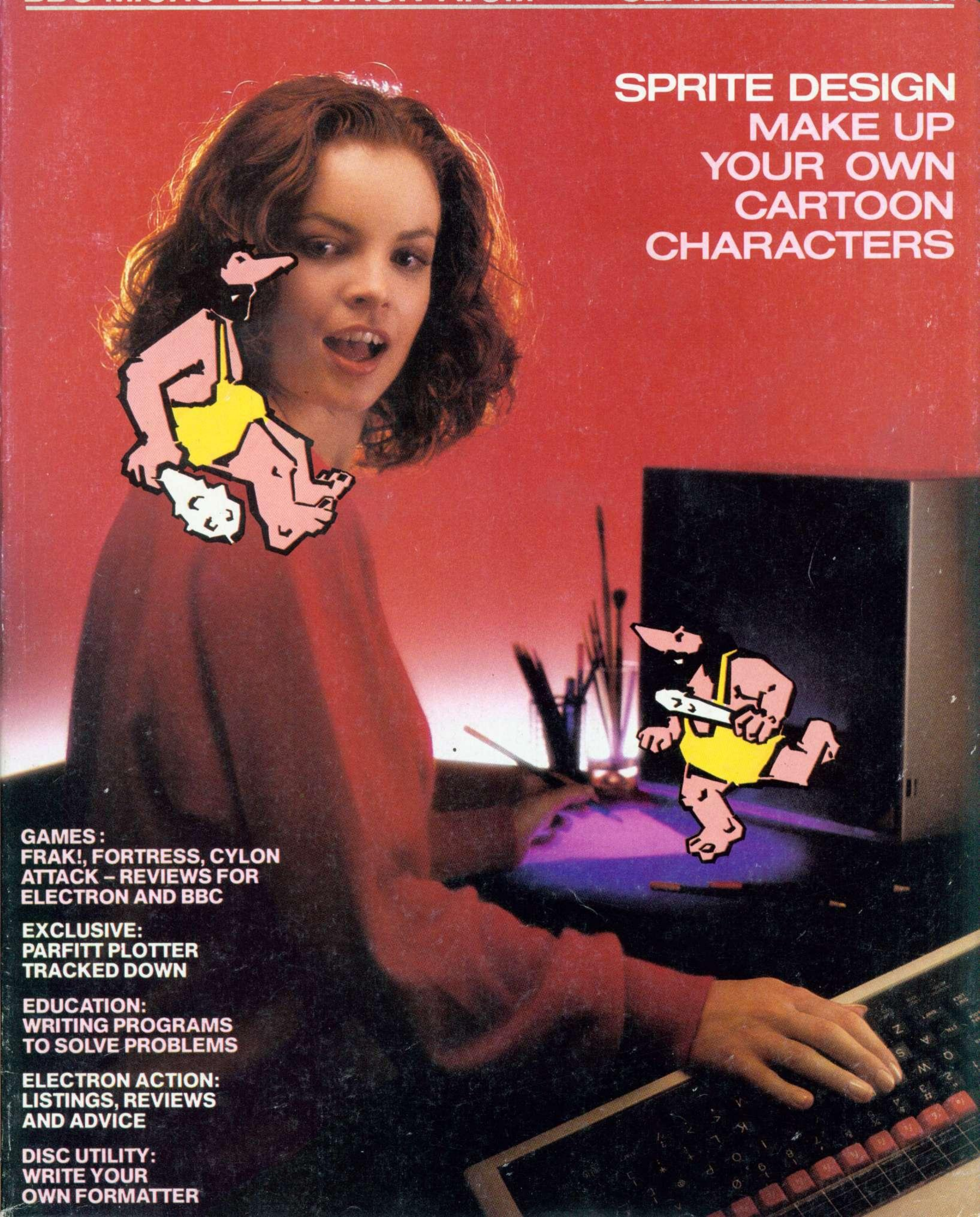
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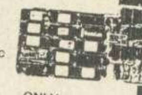
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September 1984 **No 26**

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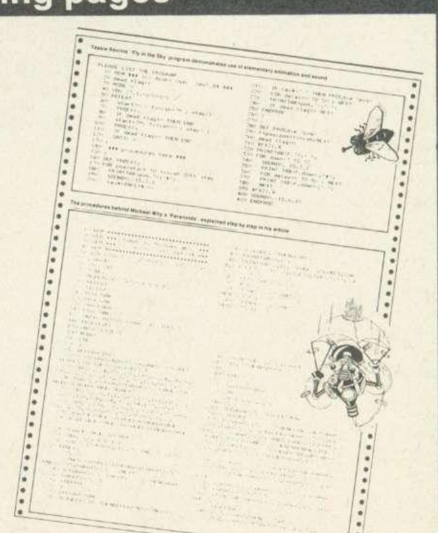
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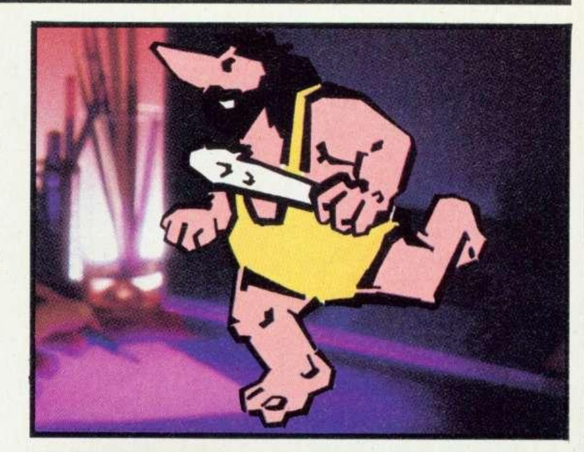


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GETTING ANIMATED









NEXT MONTH. . .

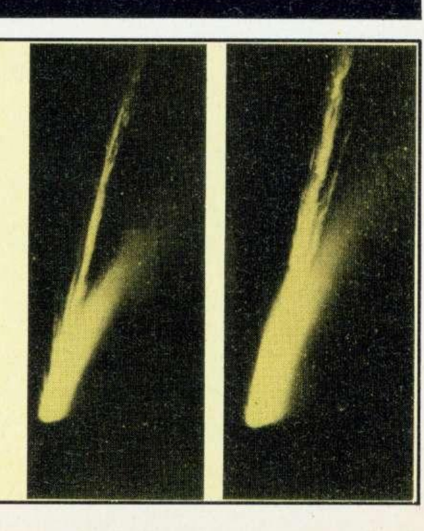
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Software to play tunes on



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Until recently a very special range of applications and utility packages for the BBC micro has been unavailable to the general public.

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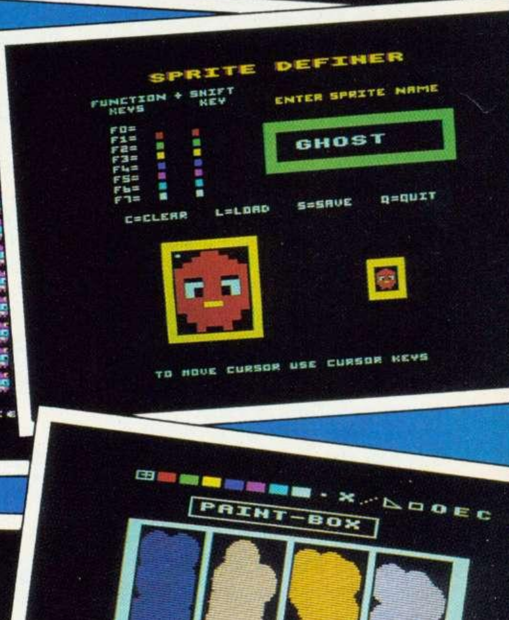
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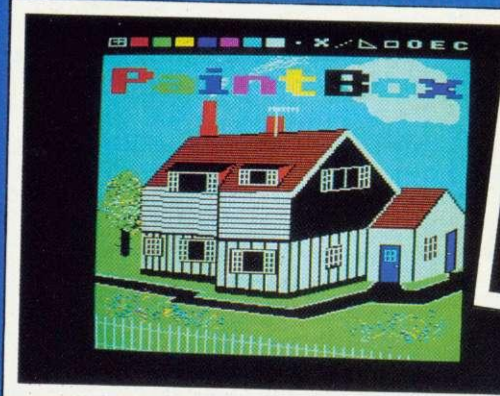


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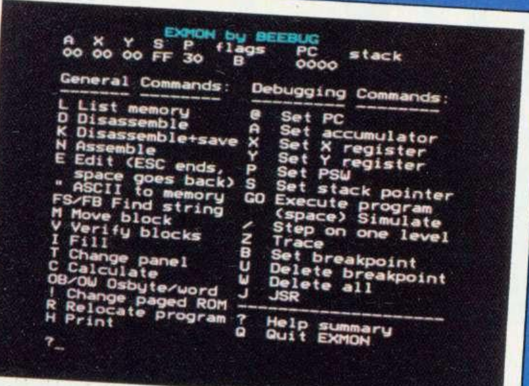
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Hitachi – in a word reliability

MAY WINNER

AFTER much deliberation over the 8,000-plus entries for our May competition to count to a million, the winner was John Faris of Oakham, Leicestershire.

He wins a BBC micro wordprocessing system worth £1,100. The winning time was 1.004 seconds to count from one to a million.

See next month's issue for a full report – and the reasons why times of 0.28 seconds were disallowed. Meanwhile, *please* don't phone us to say you wuz robbed!

Communitel: private view, guest access

by Geoff Nairn

COMMUNITEL is the latest viewdata package for the BBC micro – and also one of the most sophisticated. The basic £45 version lets you create a private viewdata system comprising an editor to create the pages and put them on the database, a program to search and display the pages, and a carousel feature.

Packaged with a BT-approved 'intelligent' modem it sells for £325. In addition to the features outlined, the Beeb can act as a terminal to access Prestel and other viewdata systems. Frames from the remote system can then be put onto the Beeb's local database. The maximum capacity depends on your disc drives: a single 100k drive will hold 95 frames. Telesoftware can also be downloaded.

The most remarkable feature of Communitel – and the one that justifies the £325 price-tag – is the Host system. Using this, the roles are reversed and other people can dial into your private viewdata system.

A telesoftware formatter will convert any text or data file into standard telesoftware format and so make it available to outside callers, no matter what machine they are using.

The Communitel was designed at the Notting Dale Information Technology Consultancy Unit.

New law opens up the potential of teletext

A CHANGE in the law looks set to revolutionise television teletext and establish it as a realistic rival to viewdata services such as Prestel accessed via the telephone.

At present the Independent Broadcasting Authority, which runs Oracle, is allowed to broadcast only uncoded signals, which, of course, cannot be charged for. However, new legislation will give the Authority the right to transmit scrambled information and make subscribers hire decoding equipment.

The prospect was opened up by a last-minute amendment to the Cable and Broadcasting Bill in Parliament. The change was added, with total indifference from most MPs, by Home Office minister Douglas Hurd.

He explained that the IBA had approached the Government with a request for powers to provide new teletext services. 'In particular,' he said, 'it was thinking of providing new information services to specialist occupation or professional groups, such as doctors and farmers, on a subscription basis.'

Receiving Oracle and the BBC's Ceefax is, at present, free (assuming you have a teletext receiver), and downloading free software from Ceefax can be done with a BBC micro and an Acorn teletext adapter.

Britain is estimated to be about five years ahead of the rest of the world in teletext technology and its potential has not been appreciated fully.

Oracle's sales and marketing controller, Humphrey Metzten, reckons the possibilities are immense: 'The technology provides opportunities we had not even conceived when we first began transmitting teletext.

'It was regarded, quite rightly, as a public broadcast service and got lumped with television. But we are now talking about a totally new medium... of which we still don't know the full potential.'

An early application will be aimed at halting the boom in credit card frauds, now totalling about £40m a year.

PROVISION OF ADDITIONAL TELETEXT SERVICES

—(1) If the IBA provide additional teletext services, then, for the purpose of enabling a teletext contractor to make charges for the reception of transmissions containing material provided by him and broadcast in such a service, the IBA may, notwithstanding anything in the 1981 Act, broadcast the transmissions in such a form (whether scrambled, encoded or otherwise) as will prevent any person from receiving them unless he obtains from the contractor the means of doing so.

(2) In this section and in the 1981 Act "additional teletext service" means a teletext service (other than a DBS service) which is additional to those already provided by the IBA under the 1981 Act.'.—*[Mr. Hurd.]*

First reading for the teletext clause in the Cable and Broadcasting Bill. It permits scrambled Oracle signals.



CARRY ON, CURRY – The BBC has extended its contract with Acorn for another four years. This means that Acorn's Model B can still bear the 'BBC' name. Half a dozen other suppliers had approached the Corporation with alternative machines – among them ACT and Sinclair. Witnessing Acorn chairman Chris Curry's signature on the agreement are Dr Hermann Hauser, Acorn joint MD (left); Bryon Parkin, MD of BBC Enterprises; and (seated) Bill Cotton, BBC Enterprises chairman. When the four years are up, the BBC Model B will be more than six years old. In the meantime, Acorn talks of the micro's expansion possibilities – both existing and planned. On the subject of a 'Model C' it's 'no comment', however.

US database at local call rates

DIALOG Information Services has set up a dial-up computer information service for home micro owners.

Called Knowledge Index, this is a smaller version of its massive Dialog service, used by researchers, scientists and libraries. Dialog provides on-line access to more than 200 specialised databases and contains over 100 million items of information.

Knowledge Index offers 20 databases, accessing more than 20 million summaries of books, newspaper articles, technical reports and computer programs.

All this information is stored in the US, but you don't have to pay transatlantic phone charges – just a local rate. This is because you use British Telecom's Packet Switch Stream Service and so dial one of the 18 or so regional PSS numbers.

With the service restricted to outside office hours (6pm to 5am), Knowledge Index is cheaper than the full Dialog service at $24 an hour.

Further details: Knowledge Index, PO Box 8, Abingdon, Oxford OX13 6EG.

The thoughts of chairman Curry

Chris Curry recently gave evidence to a House of Lords select committee. Here, Bill Penfold reports on some of the topics on which the Acorn chairman spoke his mind.

COMPUTER classes are a 'den of thieves' because of the way teachers rip off educational software, claims Acorn chairman Chris Curry.

In evidence to a House of Lords select committee, he told their Lordships that this was one of the reasons for so little decent educational programs. Software houses, he said, were being put off because of the way programs would be pirated.

Most of the software industry regarded the schools as 'a den of thieves,' and as a result most of the programs are being produced by the teachers themselves.

But he said there was also an 'encouraging' black economy in schools software from pupils.

'There is an enormous industry amongst children at school, producing material from curriculum material that they are learning, which they are then selling on to other people.'

BRITAIN's bid to get in on the 'fifth generation' computers is in trouble, claims Chris Curry.

The British programme, Alvey, was set up with Government blessing and cash based on the hope that it would prod the home-based computer industry towards the fabled fifth generation.

Curry cast doubts on whether Alvey had proved stimulating and attracted people. That might have been true in the beginning, but not any more, he said.

Though admitting that Acorn was involved in the venture he bluntly told the Lords: 'The general belief is that the Alvey programme is faltering badly, and that it is in serious need of some re-invigoration.'

The big worry, he explained, was that the funds would be 'gobbled up by the big companies that had traditionally got the Government money'.

A MAJOR question mark is hanging over the future of classroom computers once the present MEP comes to an end later this year and it is worrying Chris Curry. In particular, will teachers still get the necessary training?

He told the select committee of his concern that the progress achieved over the last few years is continued once government funding runs out.

He reckoned the MEP had done a good job on in-service training, but only about 20 per cent of teachers had received a basic awareness level training in modern information technology.

'It would be wrong to think without Government support local authorities will be able to maintain the level of support that the MEP has been providing,' predicted Chris Curry.

What he would like to see was colleges and departments of education being encouraged to ensure all student teachers are familiar with new technology.

DON'T bash Basic because it'll be around for some time yet, according to Chris Curry – a view very different from much of the received wisdom presented to the parliamentary inquiry.

Many of the witnesses said Basic was a barrier and should be dropped as a computer language in schools.

However, the Acorn chief believed that was probably only half right. Acorn, he told the committee, still used Basic as the main programming language and he thought so did most of industry.

'I know there are probably arguments for using high level languages, but Basic has been a very good workhorse so far, and I think it will last us some more years,' he said.



Chris Curry . . . gave evidence

Curry taken to task

CHRIS Curry was taken to task over his evidence on encouraging girls to use computers.

Lady Lockwood complained that the Acorn chief had been apologetic in the way he had explained the need for programs on subjects like knitting. 'The whole problem is that the so-called masculine subjects have always been taught in a way which does interest boys. I do not think you would have made the same apologetic point had the program been concerned with cricket, or, as so many games are, with warfare.'

Lady Lockwood insisted that computer companies should be looking at subjects girls were interested in.

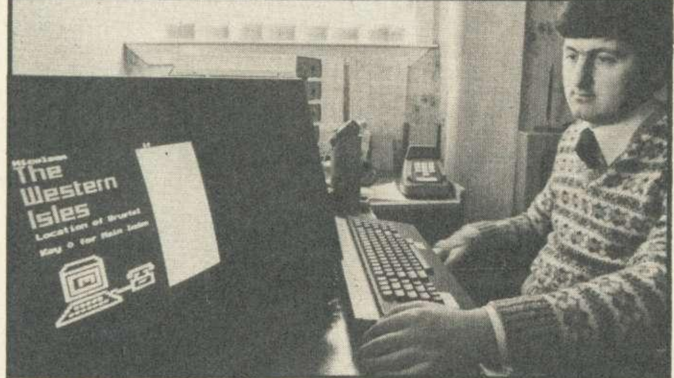
Gaelic news on a Torch

THE Western Isles of Scotland may be remote but they no longer need be out of touch.

A local viewdata system similar to Prestel called Bruetel has been running since April in the islands' schools and eventually the service will be accessible by anyone.

A Torch computer holds about 3500 pages on a hard disc, which outlying schools can dial-up using a modem and their BBC micro. At the moment, 26 schools have the necessary hardware but soon all of the 70 schools in the Western Isles Island Council's area should be on-line.

The pages contain local news, 'what's on' information, educational items and response frames. Some pages are written in Gaelic. After the service has been tested in schools, it will be extended to local communities.



Kenny Matheson in control of the Bruetel system on a Torch

Micro upgrade kit for Beeb

THE Beeb's 6502 microprocessor has been given an overhaul by one of its manufacturers Rockwell International.

The upgraded processor is christened the R65C02 and uses CMOS technology. In giving the processor a facelift, 31 new instructions have been added.

RCS Microsystems is marketing a 65C02 upgrade kit which also includes patch software to implement the new opcodes mnemonically in the assembler. The kit costs £17.25. Further details on 01-979 2204.

Pace first with drive link for Electron

THE race to produce the first disc interface for the Electron has been won by Pace. The interface, christened 'Le Box', consists of a power supply, PCB with interface and upgraded Amcom Disc Filing System and 5¼in disc drive. Price of the complete interface, including the Pace disc drive, will be £299 plus VAT, and Pace is willing to provide the interface on its own for about £100 less.

Le Box sits underneath the Electron and includes the facility for adding a second drive. Based on the 8271 disc controller chip, the unit is normally supplied with a single-sided 40-track drive providing 100k of storage per disc. Other drives may be supplied on request, including a 40/80 switchable unit offering 400k.

Le Box also includes eight sideways ROM sockets to allow Electron-compatible ROM firmware to be used. First units for retail sale will be at the Acorn User Show.

Hunting the hare

HARESOFT has launched a computer version of the famous *Masquerade* treasure hunt. Readers of Kit Williams' book had to locate a buried golden hare, and Haresoft has bought it off the winner and is offering it as a prize in the software puzzle – or the winner can have £30,000 in cash.

No digging this time – you just tell Haresoft where the hare is hidden. The program is produced in two parts costing £8.95 each; the first tape is already out and the second will be released next month. Haresoft is at PO Box 365 London NW1 7JD.



The BBC MIDI interface from Rose-Morris will work with any MIDI standard synthesiser. Hear it at the Acorn User Show

Electron gives C4 a hearing

NOTWITHSTANDING the renewal of its contract with the BBC, Acorn is including cassette versions of programs featured on Channel 4 in its Electron starter pack.

Along with the micro, buyers will get a cassette recorder, *User Guide*, beginner's programming manual, introductory cassette – plus a book and software tape based on Yorkshire Television's *Me and My Micro* series. The starter pack costs £245.

The five progammes, first shown on Sunday mornings in June, are to be repeated on Monday evenings at 5.30 on Channel 4, starting September 17. They aim to teach Basic programming to the complete novice – unlike the BBC's computer programmes which cover mainly applications. The computer programs featured in *Me and My Micro* can be used with any machine. The listings are available on cassette for the Spectrum and Electron, and it is these tapes that are included in the Electron starter pack.

Acorn has also extended its range of Electron software from 12 titles to 30, all of them being conversions of Beeb software. They include *Desk Diary*, *Creative Graphics*, *Personal Money Management*, *Draughts* and *Snapper*.

● Plus-1, the Electron's ROM box, has come in for criticism because two of the programs on the introductory cassette will not load when it is connected to the computer.

The problem is caused when the Electron tries to read data files. The Plus-1 can be 'turned off' with a series of *FX calls and normal operation restored, but nevertheless the fault is an embarrassment in a product aimed at the inexperienced user.

Beeb-bopping on six tracks

ROSE-MORRIS, which sells musical instruments, is marketing a synthesiser interface unit for the BBC micro. Using a compatible keyboard synthesiser, up to six tracks of music can be composed and then stored in the Beeb's memory. On playback, notes can be altered in pitch and length using the red function keys and the music can be displayed in notation form on the screen.

The interface costs £159 and will work with any MIDI synthesiser (MIDI – Musical Instrument Digital Interface – is the connection standard for computers and synthesisers). The cheapest MIDI synthesiser costs about £500.

The BBC B MIDI, as the interface is called, consists of a small box which plugs into the Beeb's user port and 1MHz bus, while the other end connects to your synthesiser. This is the first home computer MIDI interface and it will be at the Acorn User Show.

Video mixing

A RANGE of products from Video Electronics enables the BBC micro to interface with other video equipment.

Beeb-Lock is a small box which synchronises the RGB video output of the micro to an external signal – from a video recorder or camera, for example. Once synchronised, the two signals can then be mixed. A typical application would be to superimpose captions or graphics onto a video picture; the captions are typed on the Beeb and the picture comes from a video recorder.

The basic Beeb-Lock, costing £220, takes its power from the BBC micro auxiliary power socket. An enhanced version, at £380, comes with its own power supply and a 'Downstream Mix/Key' feature, which lets you add computer text to the video signal without having a separate video mixer.

Planned for the autumn is a colour mapping board that should interest Acorn Bitstik users. Instead of being restricted to the Beeb's eight colours, you can make up your own from a palette. The Bitstik exploits this feature by letting you 'mix' the colours on the screen. Video Electronics is at Wigan Road, Atherton, Manchester.

Beeb learns more languages

TWO new languages join the Acornsoft range: S-Pascal and Turtle Graphics.

S-Pascal is a subset of the full language, aimed at the education market. One major limitation is that it only supports integer number variables. Turtle Graphics is a subset of the Logo language, using just the graphics commands to move a 'turtle' around the screen. Both languages cost £16.85 on tape or £19.90 on disc.

Full implementations of both Logo and Pascal are planned for the autumn. Pascal will come on two 16k ROMs and will conform to the ISO specification. Acornsoft's Logo, also on two ROM chips, will be able to control floor turtles.

Three other versions of Logo for the BBC micro are due to arrive next month. From the Open University, LSL and LCSI. LSL's version will come on a 16k ROM chip, the others on a 32k chip.

Acornsoft also promises for the autumn a BBC micro version of Comal on 16k ROM.



The Graduate.

The first IBM PC compatible upgrade for the BBC model B micro.

From only £764.00 the new Torch Graduate will upgrade your BBC Model B to a powerful 16 bit business computer

TECHNICAL  SPECIFICATION

- 8088 16-bit processor running at 5 Mhz
- 128K or 256K RAM
- MS™-DOS operating system customised to IBM compatibility
- Model G400 – Single, double sided, high density disc drive (320K formatted)
- Model G800 – Twin, double sided, high density disc drives (640K formatted)
- Integral stabilised power supply
- 2 IBM PC compatible hardware expansion buses
- Software compatibility allows Lotus 1-2-3 and all popular IBM PC business programs to run without modification, subject to the constraints of the BBC keyboard and display
- Disc interface is not required
  Keyboard text and graphics supplied by BBC Model B

• THE GRADUATE •

Disc and hardware compatible with the IBM PC, the Graduate is the latest addition to the Torch range of BBC upgrades. It's MS™-DOS operating system is customised to IBM compatibility allowing exploration of the massive range of IBM compatible business software, programming aids, compilers and languages universally available from most major software houses.

Introduction to MS™-DOS

The Graduate offers two levels of upgrade, the G400 and the G800, both with 128K on board user memory as standard (optionally 256K). This can be increased to 1.2 Mbytes with an IBM compatible expansion board. The G400, contains a single, double sided 320K formatted disc drive and provides the low cost introduction to MS™ -DOS for the user who wants real 16 bit power from his Model B.

More data storage

A step up from the G400 is the G800 which offers twin, double sided 320K disc drives for extra data storage. Both the G400 and the G800 provide the possibility of further expansion for networking, modems, etc., via the IBM compatible hardware slots provided by the Graduate models. Each model comes complete with a well written user/technical manual and connecting leads.

Just plug it in

Unlike other add-ons there is no need to open the BBC to make the connection. The compact and tidy Graduate models simply plug in to the 1MgHz bus on the Model B. Within minutes you can be up and running with an IBM PC compatible system that really means business.

The range

Add 256K RAM, 640K disc storage and IBM PC compatibility to the BBC Micro for less than £1,000.

Graduate G400 (128K) £764 inc.VAT
Graduate G400 (256K) £815 inc.VAT
Graduate G800 (128K) £949 inc.VAT
Graduate G800 (256K) £999 inc.VAT

For further information complete the coupon today.



TORCH COMPUTERS



Lighting the way ahead.

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Abberley House, Great Shelford, Cambridge CB2 5LQ.
Telephone (0223) 841000. Telex 818841 TORCH G.

The Graduate is manufactured by Torch Computers under licence from Data Technologies Ltd.

To: Torch Computers Ltd., Abberley House, Great Shelford Cambridge CB2 5LQ. Telephone (0223) 841000
Please send further information on the Graduate and the address of my nearest dealer.

Name ______________________

Address ______________________

____

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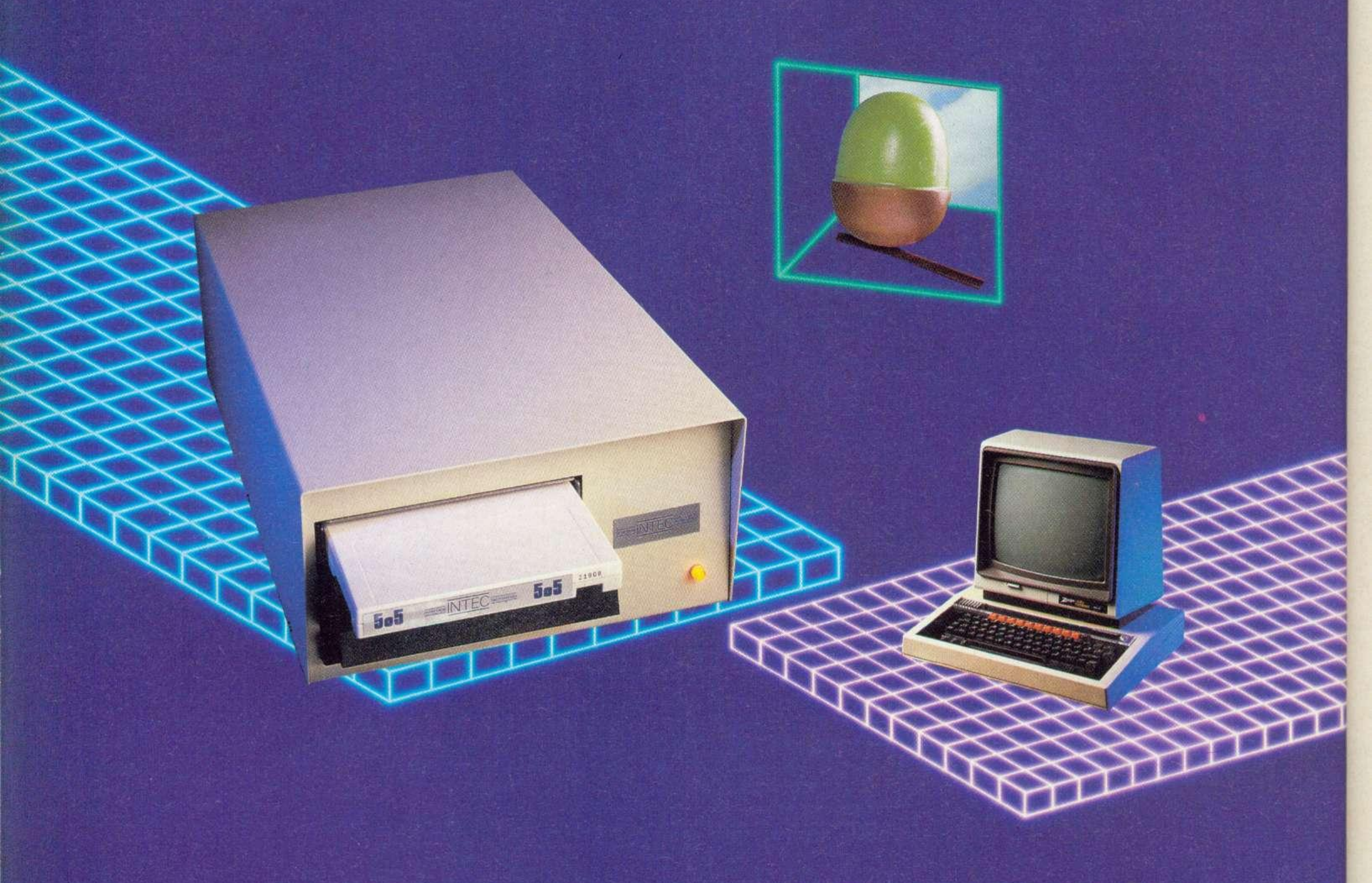
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20,000K Winchester Disc for your BBC Micro

INTEC MAKES THE BBC REALLY COMPETE WITH SYSTEMS COSTING 2X AS MUCH!



- Supports BBC and Acorn DFS.
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- High speed accessing.
- UK manufactured.

The INTEC 5o5 gives all these benefits PLUS the removable hard disc cartridge providing a compact, secure and usable back-up or cartridge per application approach. Why pay more for less?

For full details on the INTEC range of hard discs for the BBC Micro, complete and post the tear-off slip or **phone INTEC now – 01-761 5999.**

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1984

Please Cut Out and Return
The INTEC Hard Disc Range
5-20 Mb Winchester and the fixed and removable 5o5.
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BBC

INTERFACE TECHNOLOGY
INTEC



The 2nd Official Acorn User Exhibition

Held for the first time at London's Olympia 2, the Acorn User Show this year runs from Thursday August 16 to Sunday the 19th. Hours are: Thursday 10-7 (morning, trade-only), Friday and Saturday 10-6, and Sunday 10-5.

Beeb shows confidence as a business tool

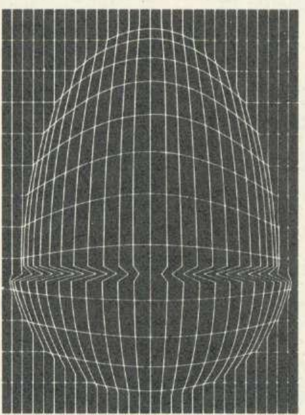
FOR the business user, big or small, the BBC micro now offers some powerful systems and this will be reflected at the show. The Torch subsidiary of Acorn now has a range of upgrades for the BBC micro from the Z80 second processor at £340 (with the Perfect series of software), to the Unicorn, which at £3300 gives access to the powerful Unix operating system and a 20Mb hard disc. See page 139 for review.

Torch has also taken over the Graduate upgrade from DTL and is selling the cheapest version at £765. The Graduate has a 16-bit processor, 128k of RAM and a 400k disc drive. More important, it is compatible with the large range of software available for the IBM PC, even to the extent that IBM discs will work on the Graduate.

Acorn's own Z80 second processor, sold with a mixed bundle of business software, will also be highly visible. No doubt the Acorn right hand will pretend the Torch left hand doesn't exist. Another intriguing point: will Acorn be mouthing the initials ABM?

Intec will be promoting its 505 Winchester disc drives with an 'adults-only' ice lolly competition. It's not quite as risqué as it sounds. You get a Walls Megabyte ice lolly and are then entered in a lottery; if your name comes out of the hat you win one of Intec's 505 Winchester disc drives, worth more than £3000. The 505 will connect up to your Beeb and has removable hard discs – so offering virtually unlimited storage. Why 'adults-only'? Well, Intec is determined to prevent its stand being besieged by children thirsting for a free ice-lolly.

More show news and information on page 18



If you are looking for a printer yet are worried about how to get it to work correctly, then CJE Micro's stand is one to visit. The company is offering a range of printer packs using Star, Juki and Canon printers. In the pack you get the printer, a cable for the BBC micro, View printer driver, a screen dump program, operating booklet, 100 sheets of paper and even a mains plug! Typically such a package adds about £20 to the price, but CJE is promising cheaper prices for the show.

Win a monitor or a printer

THERE's a prize to be won every day at the Acorn User Show. In an easy-to-enter competition *Acorn User*'s publisher, Redwood, is giving away two Microvitec colour monitors and two Acorn spark-jet printers.

All you have to do is answer the six questions posed on page 5 of the show guide, complete the rest of the entry form and hand it in during the exhibition to Redwood Publishing at stand 98.

The first correct entry picked out of a hat each day will win a monitor (Thursday and Saturday) or a printer (Friday and Sunday). Runners-up will receive *Acorn User* games packages.

Winners will be chosen at 6.30pm each day and prizes forwarded after the show finally closes on Sunday, August 19.

Quinkeys in quadruplicate

THE Quinkey is an 'alternative keyboard' for the Beeb developed from the well-known one-handed Microwriter. Its maker, Microwriter Ltd, supplies an interface that allows four Quinkeys to be connected to the Beeb simultaneously in a special education pack with software. For a full review and prices turn to page 145 of this issue, or see the Quinkey in action at the show.

Data Efficiency will be showing two pieces of hardware of particular interest to schools: the Strobe graphics plotter, which comes with BBC micro software and costs £229, and the Taxan NLQ dot-matrix printer, which for just £344 offers near letter-quality print (reviewed in the June issue).

Keyzone's 'Printersharer' is a switch unit that enables up to six computers to share a single parallel printer. A serial version is also available. The 'Printerchanger' works the other way round – one computer can switch between three different printers. Few schools will have the luxury of three different printers, but many businesses use both dot-matrix and daisywheel printers from a single micro.

Thomas Nelson, one of the largest educational publishers, will be showing its Nelcal range of software. New titles include *Statpack*, a data-logging package for science subjects; *Biology* for A-level students; and *Micromapping*, a suite of six programs that develop map skills in junior children.

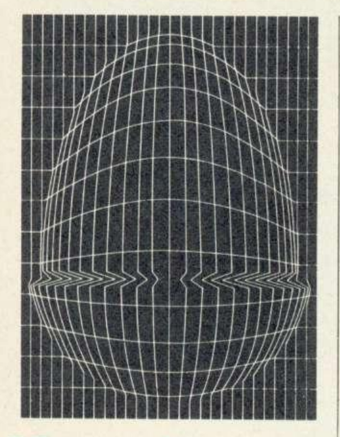
Elk gaps plugged

As an economy version of the BBC micro, the Electron has several shortcomings. The lack of a joystick port, for example, is a serious omission in a home computer, and several companies have been quick to plug the gap.

Sir Computers has produced a PrintStick interface which, as well as letting you use joysticks with the Electron, also gives it a Centronics printer socket. You can take one away at this year's Acorn User Show for just £39.95 – a saving of £5 over the normal price. First Byte Computers will be selling a 'no-frills' joystick interface for £24.95.

Both joystick ports are for digital switch-type joysticks such as the Atari, rather than the analogue potentiometer version which Acorn markets. If you want to use joysticks with a program, you should first find out which kind it uses.

Electron owners also complain at the lack of mode 7 graphics on their machine. Sir Computers has come up with the first mode 7 adaptor, a demonstration version of which will be unveiled at the show. You won't be able to buy one there, but when they go on sale they should cost well under 100.



More elbow to Beeb's power

GRAPHICS tablets seem to be this year's favourite peripheral, especially with schools, and at least three rival versions will be on display at the show.

The CTS Professional tablet – the most expensive – uses a magnetic tablet and pen to give a resolution of 0.25mm and a high degree of linearity and accuracy. To exploit the tablet to its full, a software package called *CADPAK-D* lets you scale, zoom and rotate drawings, and reproduce common shapes. The tablet costs about £630, plus £55 for the CAD software.

Much less expensive at just £50 is the graphics tablet from Reekie Technology. The Image Plotter both resembles and works like the traditional drawing pantograph arm used for tracing drawings and photographs. Scientific Systems has a similar product, the Tarren Digigraph Plotter, which it sells for £91.

Confusingly, the word plotter is used to describe both input and output devices. Parfitt Electronics' DP025 Plotter, reviewed on page 147, falls into the latter category. Using commands similar to BBC Basic's DRAW and MOVE, and cheap fibre-tip pens, it can plot complex shapes and diagrams on paper. Alternatively the pen can be replaced by an opto-sensor, and drawings can be scanned and displayed on the screen. The basic plotter costs £270.

The Droid Factory's £400 robot arm was covered in last month's preview and Commotion will be showing its Beasty Arm. It has all the features of its big brothers for £30.

HOW TO GET THERE

Olympia 2 is the new exhibition centre next to the old Olympia, Earl's Court. It has it's own Tube station and three others are close by. Bus routes 9, 27, 28, 33, 49, 73 and 91 pass the door, and there's car parking.

Phloopy firms up

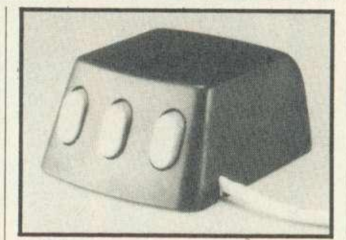
The Phloopy Data Storage System, first launched in March but not seen since, will receive its first real public airing at the Acorn User Show. It offers the same storage capacity as a single disc drive – 100k – yet costs only £99.

Using a continuous loop of magnetic tape, the Phloopy offers a typical access time of three to four seconds. Although not as fast as a disc drive, this is an obvious improvement on normal cassette tapes.

The unit costs £99 plus £26 for the BBC interface and can be bought at the Show from Phi Mag Systems. This company is based at the Tregoniggie Industrial Estate, Falmouth, Cornwall TR11 4RY. Tel: (0326) 76060.



The 100k Phloopy continuous tape storage system goes public at the show. It costs £99.



Mouse to go iconographic

MORE details have emerged on the revolutionary AMS Mouse, first announced in last month's AU. It has three buttons on top which, along with the four-way movement, can be programmed to replace up to seven conventional keys on the keyboard.

No applications software is yet available, but AMS has developed basic routines to show how it can be used. The control software is held on a ROM chip and, at its simplest, enables the mouse to move a cursor on the screen, replacing cursor keys or joystick. Other software has been developed that speeds up program editing and similar tasks and includes a routine to work with the *View* wordprocessor.

Perhaps the most exciting development for the mouse is 'icon' software. Anyone who has seen Apple's Lisa or Macintosh will recognise icons as the symbolic screen drawings which represent different functions. For example, moving a file from a filing cabinet icon to a waste-paper bin icon deletes a file!

AMS is hoping software houses will incorporate icon routines into their programs, and its aim is for an integrated mouse package of graphics, spreadsheet and WP.

YES!

"On-board" microprocessor.

Electro magnet to pull motor spindle onto tape.

Nine track "byte-wide" head.

Tape drive spindle.

Precision ground rubber pressure roller.

Twelve foot long loop of tape freely packed into cartridge.

PHLOOPY 100k cartridge, shown not yet pushed fully home.

A 100k BBC-drive for £99 + VAT

We've done it! We've built a storage system for your BBC Micro with the power and convenience of a floppy disk drive, at a fraction of the price. Interface to the BBC costs £26 + VAT and runs up to 8 drives.

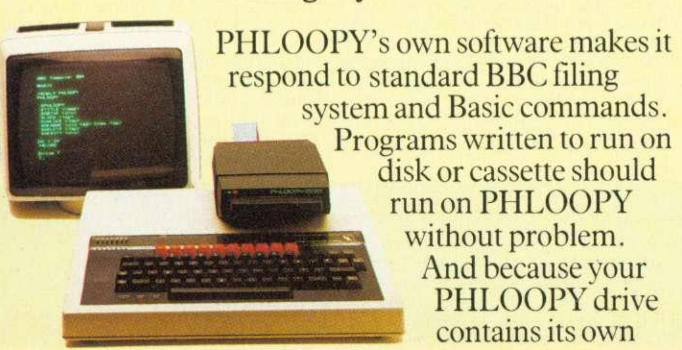
PHLOOPY's special secret

PHLOOPY does not record on a disk, but on a loop of quarter-inch tape contained in a rugged interchangeable cartridge.

The heart of PHLOOPY is a unique "byte-wide" magnetic head, that gives it its speed by recording nine tracks across the tape. Typically, you can access a file in only 3 or 4 seconds.

If you're used to waiting for a cassette tape to trundle programs into your BBC, you'll be amazed at PHLOOPY's performance – up to 100 times faster.

Talking to your PHLOOPY



PHLOOPY's own software makes it respond to standard BBC filing system and Basic commands. Programs written to run on disk or cassette should run on PHLOOPY without problem. And because your PHLOOPY drive contains its own microprocessor – a second computer which does most of the hard work – it puts very little load on the BBC. The on-board computer also checks and automatically corrects any read errors.

Your PHLOOPY Library

PHLOOPY cartridges hold a full 100k of data. You can buy blank cartridges for £3.75 each plus VAT. Many BBC programs will be available on PHLOOPY.

Phi Mag Systems Ltd. PO Box 21, Falmouth, Cornwall TR11 3TD Tel: (0326) 76040

Order Form

- Please send me further details about the PHLOOPY 100k data storage system for the BBC Model B.
- Please send me_____(qty) PHLOOPY starter pack(s) for my BBC Model B microcomputer, including PHLOOPY drive, BBC interface, leads, connections, operating system in firmware, manual, and two PHLOOPY 100k cartridges, at £147.75 each including VAT, postage and packing. Amount £_____
- Please send me_____(qty) packs of 5 PHLOOPY cartridges at £19.75 including VAT, postage and packing. Amount £_____

I enclose a cheque/PO for £_____ OR Please debit my Access card Number: _____

Your order will be acknowledged within 10 days, giving a delivery date.

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Address_____

Town:_____ Post code_____

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The Torch upgrade will give you a sophisticted business/professional system. However it doesn't stop there — it gives you the potential to expand — an expansion that no other current system can offer. Today, (not promises of 'one day'!), we are able to offer Hard Disc capability, networking of up to 254 machines, right up to the extra processing power of a 68000 32bit processor with 256K RAM, and optional UNIX operating system. **The potential is here!** The TORCHNET system, (software is included with all systems!), is a cost-effective method of linking office computing equipment in a simple and expandable fashion. TORCH means communication, whether it is inter-room communication, automatic 'home-to-office' communication, or electronic mail allowing a Torch user to initiate telex transfers, send telemessages, use Electronic Mail (e.g. Telecom Gold), and talk to large mainframes. — **The potential is here!** Hardware is of no use without a suitable range of software, and the Torch can choose from a massive range of business, financial, application and language software. (Did you know that the Torch system has five times more software available for it than the IBM PC!) Why not contact us for your requirements?



TORCH Z80 DISC PACK

The proven upgrade for the BBC Micro. Comprising 2 × 400K disc drive, Z80 processor with 64K of memory, and a CP/M compatible operating system. The system is supplied complete with the PERFECT software range including PERFECT WRITER, PERFECT SPELLER, PERFECT CALC, and PERFECT FILE. Full TORCHNET software is also supplied allowing sophisticated networking between other units and Z80 Basic. Disc Pack **£699** (a).

GRADUATE
IBM PC Compatible Upgrade for BBC B
Ask for delivery date

The TORCH Z80 SECOND PROCESSOR CARD — for those who already have suitable disc drives. The card is supplied with all the free perfect software and Z80 basic, as detailed above, presenting a very attractive package. **£299.**

TELETEXT

Converts your BBC into a fully fledged Teletext Terminal. In addition to normal reception of Teletext pages, it is able to 'download' software as well as saving standard pages on any of the four TV channels. **£196.**

ULTRACALC

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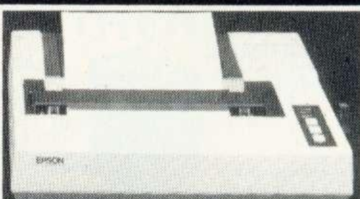
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Various add-ons greatly increase the versatility of the unit, while still retaining the unit's accuracy. The servo controlled drill/router, and a scriber enables drilling, cutting and scribing in various materials. A unique Opto Sensor (using a Hewlett Packard Device) turns the plotter into a high resolution scanning digitiser to read and store whole diagrams, for example, for use in map work. This unique versatile Workstation is supplied complete at **£490.** Basic Plotter **£270.**

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Our in depth stocks allow us to offer immediate deliveries on most items and our aim is to provide the best available products at competitive prices. In addition to the items listed above we carry extensive stocks of: connectors, connector assemblies, components including TTLs, CMOS, RAMS, EPROMs and CPUs. Spares for the BBC computers are normally available from stock. Orders from government departments, public bodies, hospitals, schools, colleges, universities and recognised PLCs welcome. We specialise in world wide exports. No VAT on exports. Our specially negotiated freight charges to many countries ensure the customer considerable savings on charges.

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PRINTMASTER ROM FOR THE FX80

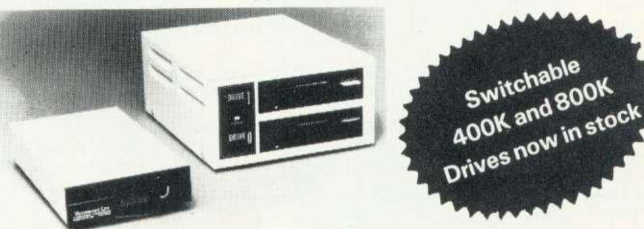
This sophisticated printer handling ROM will support the Epson MX, RX and FX range of printers, and includes many useful features. You no longer need several printer ROMS as 'this one does it all!'. **PRINTMASTER** will dump in all modes. Three types of screen dumps are available, the most flexible being ***GDUMP** which operates in any graphics mode, displaying the colours as shades. Any part of the screen can be printed at any position on the paper in any one of the four orientations. The dump can be magnified by any factor ×2, ×3, ×4 etc. A special feature allows true Mode 7 screen dumps with TELETEXT text and graphics, colours (as shades), double height etc. ***TDUMP** allows any text mode to be dumped and ***FDUMP** will print contents of a file on disc while the computer can be doing other things. The ***DEFINE** function allows the user to define his own characters and the facility to save them. Commands can be called from Basic programs and language ROMS. **All** for only **£28** (c).

VIEW PRINTER DRIVER FOR EPSON FX80

This printer driver will enable the user to fully exploit the potential of the highly versatile Epson FX80 printer making text presentation both impressive and attractive.
A choice of 12 HT code options covering the full range of FX80's fonts is made available to the user. One of the options allows the user to call up the user defined characters stored in the printer buffer. However, the most powerful feature of the driver is its ability to offer the use of multiple HT codes in the same piece of text.
The booklet suplied with the driver includes illustrative examples and shows how to prepare and store formats for frequently used documents.
Supplied on disc **£7.00**(c)

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We now stock the high performance yet economical 3M range. Due to advanced production techniques, a higher standard has now been reached, enabling Scotch to guarantee error free performance for life.

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Bit Stick **£328**(b)
Prestel Adaptor **£99**(b)

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A full implementation of the IEEE-488 standard, providing computer control of compatible scientific & technical equipment, at a lower price than other systems. Typical applications are in experimental work in academic and industrial laboratories. The interface can support a network of up to 14 other compatible devices, and would typically link several items of test equipment allowing them to run with the optimum of efficiency. The IEEE Filing System ROM is supplied. **£282.**

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Continued on page 22 →

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Preliminary Information

- **The new Eprom Programmer will now program 2516, 2532, 2564, 2716, 2732, 2764, 27128 and 27256 + 5v eproms, and all but the 27256 in a single pass.**
- The programmer will be supplied with integral power supply, and interfaces with the BBC via the 1MHz bus. It is fully buffered and complies with Acorn protocols. There is no power drain from the computer.
- **No knobs or switches to fiddle with — total control from the keyboard**
- Fully software driven with easy to understand instructions displayed on the screen.
- **Eprom type selectable from the keyboard**
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- Continuous screen display of eprom type, option and address range selected.
- **Full screen editor with HEX or ASCII input. Constant display of logical eprom address.**
- Can read, blank check, program and verify at any address/addresses on the eprom.
- **Full Tape/Disc filing facility.**
- Several basic programs can be entered on a single eprom and called up with individual name.

EPROM ERASERS



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UV1 as above but without the timer.
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Now Available

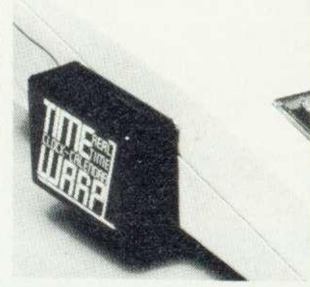
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This is the first truly flexible database for the BBC micro which will have an application to offer in almost any field one can imagine.
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*Maxm. record size 6K
*Maxm. No. of fields 62.
*9 level hierarchical search system with facilities to store results of searches. Searches can be any one of the following: Search, Include, Exclude, Combine, Common or Difference.
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EPSON FX80 PRINTER
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including BBC printer lead
Twelve Months full warranty.

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A low cost unit that opens up the total range of Real-Time applications. With its full battery backup, possibilities include an Electronic Diary, continuous display of 'on-screen' time and date information automatic document dating, precise timing & control in scientific applications, recreational use in games etc — its uses are endless and are simply limited by one's imagination. Simply plugs into the user port — no specialist installation required — No ROMS. Supplied with extensive applications software.
Please phone for details.
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SMARTMOUTH

The original 'infinite speech'. Still the best.

A ready built totally self contained speech synthesiser unit, attractively packaged with built-in speaker, AUX output socket etc. — no installation problems! It allows the creation of any English word, with both ease and simplicity, while, at the same time being very economical in memory usage. You can easily add speech to most existing programs. Due to its remarkable infinite vocabulary, its uses spread throughout the whole spectrum of computer applications — these include industrial, commercial, educational, scientific, recreational etc. No specialist installation — no need to open your computer, simply plugs into the the user port — and due to the simple software, no ROMS are needed. SMARTMOUTH is supplied with demo and development programs on cassette, and full software instructions. **£37 + £2.50 carriage.**

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This is a full specification, direct connect modem, with both Originate and Answer modes, allowing access to the many databases, bulletin boards, as well as inter-computer communications. The modem conforms to the international CCITT V21 300/300 Baud standard. (NOTE: Not suitable for PRESTEL). Having full BT Approval, it connects directly to the telephone line, for optimum performance. Being battery powered, it is totally portable (optional power supply available). **£69.**
BBC Lead **£3.50.** External PSU **£8.00.**

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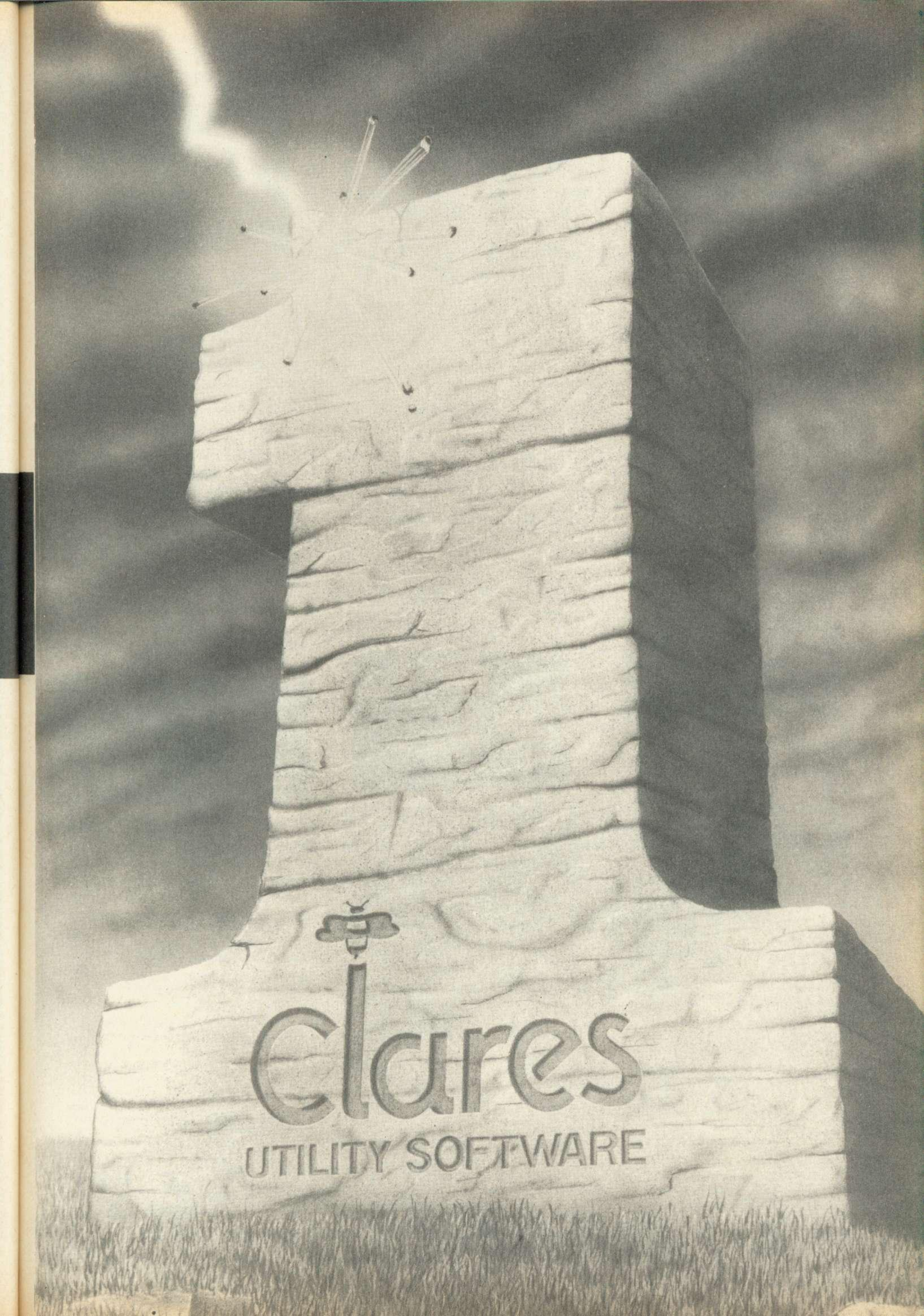
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RX80T: 100 CPS, 10" wide tractor feed	£234 + VAT = **£269**
LQ1500: 200 CPS Letter quality printer	
8143: RS 23 Interface for FX and RX printers	£29 + VAT = **£33**
8148: RS232 Interface with 2K buffer, xon.xoff	£60 + VAT = **£69**
Ribbon Cartridge for RX80 FX80 & MX80	£7 + VAT = **£7**
Ribbon Cartridge for FX100 & MX100	£12 + VAT = **£13**
STAR	
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Radix-10: 200 CPS, NLQ, 16K Buffer Par. & serial interface, downloadable characters, incredible value at	£431 + VAT = **£495**
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ALL OUR PRINTERS HAVE 1 YEAR WARRANTY

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BROTHER HR-15	
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Tractor Unit	£95 + VAT = **£109**
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*MICROVITEC
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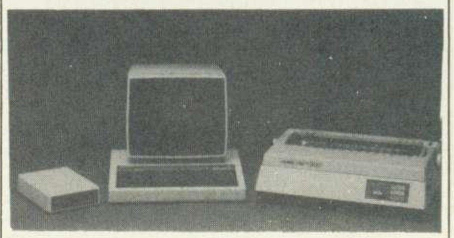
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UNSCRAMBLING THE AIRWAVES

Robin Mudge kits you out to decode those mysterious radio signals

SHORT-WAVE radio listening used to be very popular. Back in the thirties there were almost as many radio magazines as there are computer magazines now. Today modern receiver design has packed the power of those gigantic World War Two radios you used to be able to get in government surplus stores into a tiny compact portable. In this article we'll look at how you can use a BBC micro to untangle some of the blips and blops picked up by this new breed of 'transistor'.

Modern short-wave radios are small and powerful. Even the minuscule Sony 1c9600 is a full-facility receiver with the kind of pulling power that brings in stations from all over the world. When you listen to one of these sets you'll hear mixed up with the hundreds of foreign voices a strange collection of dots, dashes and chirping sounds. It is these normally unintelligible signals that are potentially the most interesting and, using a BBC micro, you can begin to unscramble some of them.

The big question is, why bother with all these special codes when it is easy these days to talk over the radio? The trouble is that transmitting voice – radio telephony – uses up a lot of radio space, and there is only a limited amount. Transmitting messages by radio telegraphy and radio teletype makes more efficient use of the radio frequencies and over long distances is more reliable. Often interference makes voice reception very difficult whereas telegraphic and teletype signals can still be decoded successfully. Because of this, those blips, blops and chirping noises often carry very interesting messages.

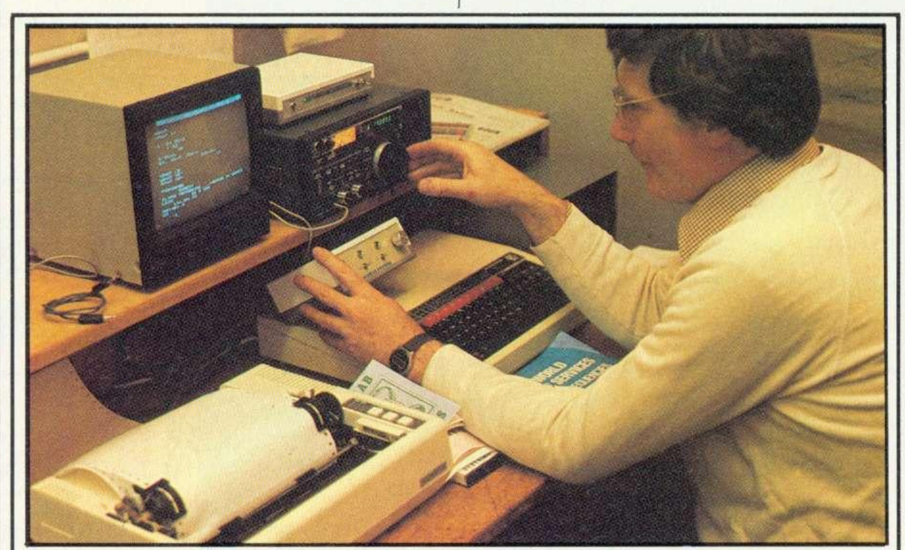
Before looking at how to receive and decode these messages a pause for some history and explanation. Radio telegraphy started in 1901 when Guglielmo Marconi transmitted the first transatlantic radio signal. He used a dot-and-dash code invented earlier by Samuel Finlay Morse. In the Morse code each letter and number is represented by a series of dots and dashes: the letter A is · — and C — · — ·.

Soon people wanted to transmit messages faster and use machines for automatic sending and receiving. The Morse code couldn't be used for this because it was difficult for a machine to recognise where one letter ended and the next started. Radio Teletype (RTTY) codes get over this problem by using a sort of binary word. Each 'word' is made up of a number of units of equal length. The asynchronous Baudot code (baud) is most commonly used today. This is made up of five data units representing alphabetic information, and because the receiver is not synchronised with the transmitter a start and stop unit are added. Each of the five data units can have a value of 1 or 0. In radio terms these are called 'mark' and 'space' respectively so, looking at the five data units, an 'a' is 00111 and c is '10001'. RTTY signals are normally transmitted at a number of different speeds. These are 45, 50, 57, 75, 100 and 110 baud.

So what do you need to turn these codes into something readable? The first thing apart from a BBC micro is a short-wave radio. You don't have to have the latest thing but you do need a good set that must be able to receive Single Side Band (SSB) signals. SSB signals are another way that radio people make better use of the available frequencies, but they can't be received without a special radio. All the new generation sets have this facility.

The Icom IC R70 is one of the top-range sets. It costs about £550 and has almost every facility that a short-wave radio fan could wish for. There are a lot of receivers between this price and about £200 and a visit to the local amateur radio shop or a glance through some of the radio magazines will introduce most of them. Two portables are worth while considering – the Sony ICF-7600D at about £160 and a British one, the Uniden Communication Receiver 2021 at about £200. Both are full-facilities short-wave radios and offer good reception on the FM band for ordinary radio programmes as well.

Next is an aerial. The two portables come with telescopic aerials but these aren't good enough to pull in the really distant stations. The simplest kind is a long piece of wire (the longer the better), either stretched from a convenient window to a nearby support or hung down the side of the house. A really neat indoor one is the Datong Active Receiving Antenna. This is only three metres long but because it uses active components is very effective



TURN ON, TUNE IN, PRINT OUT

Dan Ray takes time off from work in the television studio to pursue a hobby in RTTY. He is using a BBC micro and a short-wave radio to receive and decode radio teletype signals from the other side of the world. The teletype code is sent as two audio tones. These tones are fed from the earphone socket of the radio into a decoder that is connected to the user port of the micro. The decoder produces a digital signal that software running in the computer turns into text, which is displayed on the screen or printed out as hard copy on paper.

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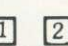
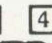
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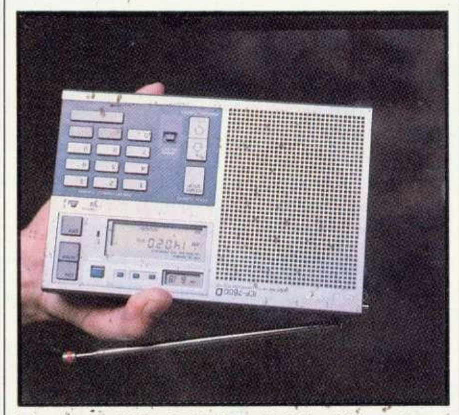


Icom receiver and home-built decoder

indeed. It costs £52. There's a version for outdoors costing £70. Both include their own power supply.

Then comes the all-important link between the radio and the computer: the decoder. When you tune into an RTTY signal it is unmistakable – it really does sound like continuous chirping. This is because the signal is made up of two tones rapidly switching from one to the other. The lower tone represents the space, logic 0, and the higher the mark, logic 1. This is called Frequency Shift Keying (FSK). The difference between the two frequencies is usually quite small on the ordinary high-frequency (HF) short-wave band (that is, between 150 and 30,000 KHz). The two frequencies are 85 and 170 Hertz. On the FM band they are 30 and 220 Hertz. The decoder changes these two tones into zero volts and five volts respectively to represent the two logic levels of the code and feeds them into the user port of the micro.

Again, a glance through the radio magazines shows a number of small firms making decoders for most of the popular micros and they supply the necessary software to work with them. One system is made by Scarab Systems, whose decoder and software costs about £70. This can accommodate the two different RTTY frequencies for HF and FM short-wave transmissions. On the front panel are two light-emitting diodes (LEDs) labelled Mark and Space. These flicker on and off in rhythm with the signal, when it is tuned in properly. The LEDs are really important because as you turn the radio tuning knob the pitch of the signals varies quite dramatically and you have no way of knowing when it is right. Turn the knob until the lights start pulsing and then you know logic signals are being sent to the computer.



The Sony ICF-7600D is a full-facilities short-wave receiver costing about £160

In essence the software's job is quite straightforward. All it has to do is detect the start and stop bits of each word, refer to a look-up table to find out what character the five data bits represent and then print it on the screen. It has to do this quickly, of course.

Scarab's software is very nice. The documentation is clear and easy to use. It allows you to select a baud rate of 45, 75 or 100 and offers the facility for driving an Epson printer. When everything is tuned in and set properly words suddenly appear on the screen, a very exciting moment. If gobbledegook starts to appear try changing the baud rate before assuming you are receiving a coded message. With practice you will be able to tell what the baud rate is by listening to the speed of chirping.

In fact Scarab's software does more than receive RTTY, it enables an amateur radio enthusiast to prepare and transmit messages as well, but you have to have a licence for radio transmission before you can do this.

You may experience interference problems from the computer itself, for the BBC micro transmits a lot of radio frequency signals. Make sure the aerial is as far away from the computer as possible. If this doesn't cure the problem you'll have to line the Beeb's case with aluminium foil and wrap all the external signal cables that come out of it in the same stuff. When the foil shield is connected to the ground it stops the interference signals from escaping.

The Scarab decoder is fine for 'standard' RTTY transmissions but one marketed by *Elektor* magazine in kit form gives provision for a much wider range of frequency shifts.

Sometimes you may not be able to resolve a signal into words at all. This could just be because it is being transmitted at a non-standard baud rate or frequency shift, or it could be that it is on one of the newer Teletype systems. There are two main contenders to the Baudot code: TOR and ASCII. The latter uses the same FSK transmission system but under the ASCII code. TOR (Telex Over Radio) is a bit more complicated. There are two types: ARQ and FEC. In both each data word has a checksum included so that the receiving equipment can tell if an error has crept into the transmission. ARQ stands for Auto Request, which means that if an error has been detected the receiving station transmits a signal to the sender asking for the last character to be transmitted. This is quite complex and requires the user to have a transmitter and a receiver.

FEC (Forward Error Correction) is simpler, it transmits everything twice and the receiver uses only the correct

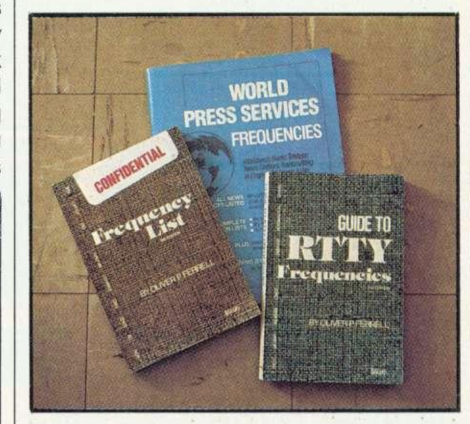


Figure 1. These books list the frequencies of most of the agencies in the world using RTTY

CONTACT ADDRESSES

Icom IC-R70 communication receiver from:
Thanet Electronics, 143 Reculver Road, Herne Bay, Kent.

Sony ICF-7600D from:
Sony House, South Street, Staines, Middlesex TW18 4PF
or any good Hi-Fi shop.

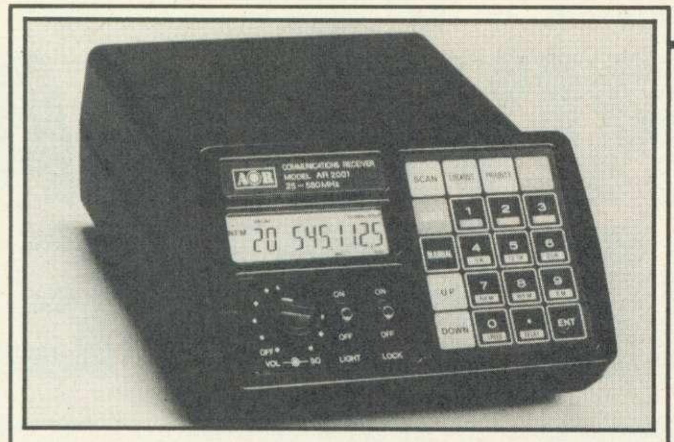
Uniden CR-2021 communications receiver from:
Lecmar Electronics, Vectis Yard, Cowes, Isle of Wight.

Datong Active Receiving Antennas from:
Datong Electronics Ltd, Spence Mills, Mill Lane, Bramley, Leeds LS13 3HE.

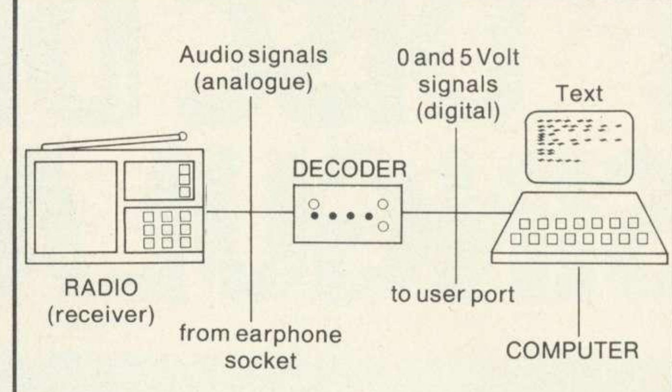
MPTU-1 Tone encoder/decoder with software from:
Scarab Systems, 39 Stafford Street, Gillingham, Kent ME7 5EN.

RTTY computer interface from:
John Melvin, 2 Salters Court, Gosforth, Newcastle.

Elektor RTTY Decoder from:
Elektor Publishing Ltd, Elektor House, 10 Longport, Canterbury CT1 1PE.



THE FM radio signals transmitted by weather satellites (see last month's issue, page 27) can be picked up on this AOR Communications Receiver AR2001 (25-550 MHz). As well as tuning in to most of the satellites and to RTTY, it of course receives domestic radio broadcasts. From Lowe Electronics, Bentley Bridge, Chesterfield Road, Matlock, Derbyshire DE4 5LE (tel: 0629 2430/2817).



The equipment you'll need to receive, unscramble and print out coded messages broadcast from far-flung parts of the world: short-wave radio (from about £160) with aerial; and decoder to convert two-tone signals into two logic levels acceptable to the Beeb's user port. The Scarab decoder costs about £70 including software – or you can build your own.

USEFUL BOOKS

The Radio Society of Great Britain supplies a wide range of interesting books, among which the following are good:

Better Short-Wave Reception	£5.83
Complete Short-Wave Listener's Handbook	£12.21
Simple Low Cost Wire Antennas	£7.52
World Radio and TV Handbook	£12.24

Order from: Radio Society of Great Britain, Alma House, Cranborne Road, Potters Bar, Herts EN6 3JN.

The RSGB administers and governs all the amateur radio clubs so is a good source of information about becoming a radio ham.

There is also a publication from *Practical Wireless* called *Introducing RTTY*, costing £1 from: IPC Magazines Ltd, Post Sales Dept, Lavington House, 25 Lavington Street, London SE1 0PF.

OTHER BOOKS

Guide to RTTY Frequencies (2nd addition) by Oliver P Ferrell
Confidential Frequencies List (5th edition) by Oliver P Ferrell
Both are obtainable from: Giffen Associates Inc, PO Box 239, 52 Park Avenue, Park Ridge, NJ 07656, USA.
World Press Service Frequencies by Thomas Harrington
From: Universal Electronics Inc, 1280 Aida Drive, Reynoldsburg (Columbus), Ohio 43068, USA.

3.58 to 3.62MHz
7.035 to 7.045MHz
10.140 to 10.150MHz
14.080 to 14.100MHz

Figure 2. The frequencies on which amateur radio transmissions may be received. They cover European, Russian and African transmissions

character. Software and decoders for both ASCII and TOR systems are appearing on the market.

That's the system: what do you listen to? Well, it's fun just tuning around the dial randomly but beware – it is actually illegal merely to receive some transmissions and if you are caught there's a possible fine of £400. You are allowed to receive the amateur transmissions and these can be found on the bands listed in figure 2. The three books illustrated in figure 1 give the names and frequencies of most of the agencies in the world using RTTY so:

——· ——— ——— —··
—··· —·—— ·

and happy listening.

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DE RCB-55/RTU-47/RCE-59/RWN-74 DE RCB-55/RTU-47/RCE-59/RWN-74
RYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRYRY
RYRYRYRYRYRYRYRYKYRYRYRYRYRWYFFXRYRYRFYFFXRYRYRYRYRY
   8/4 TASS 5-6
   SPACE 1(ONE) TWO TAKES
   JOINT RESEARCH GOES ON
   MOSCOW APRIL 8 TASS          A TASS CORRESPONDENT REPORTS
FROM THE MISSION CONTROL CENTRE:
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INTO DURING THE EXPERIMENTS +BALLISTO-3+ AND +OPTOKINESIS+. THE
RESULTS OF THE +PROPHYLAXIS+ AND +YOGA+ EXPERIMENTS WILL BE A
HELP IN THE DEVELOPMENT OF THE MOST EFFECTIVE MEANS TO MINIMISE
THE UNFAVOURABLE EFFECT OF WEIGHTLESSNESS.
   MORE
   8/4 TASS  5-6
   SPACE 2 (TWO)
   WITHIN THE FRAMEWORK OF THE PROGRAMME OF THE GEOPHYSICIAL
EXPERIMENT +TERRA+ THE CREW CARRIED OUT A REGULAR SESSION OF
PHOTOGRAPHING THE TERRITORYOF INDIA. THE EASTERN COAST OF THE
HINDUSTAN PENINSULA AND THE GANGES DELTA WERE PHOTOGRAPHED
TODAY.
   ANOTHER EXPERIMENT ON SPACE STUDY OF MATERIALS AND A
TELEVISION REPORTAGE, IN WHICH THE COSMONAUTS WILL TELL ABOUT
THEIR WORK, ARE PLANNED FOR THE AFTERNOON.
   ACCORDING TO THE RESULTS OF THE RADIO TALK WITH THE CREW AND
MEDICAL CONTROL DATA, THE STATE OF THE COSMONAUTS! HEALTH IS
GOOD.
   THE PROGRAMME OF SOVIET-INDIAN RESEARCH IN THE NEAR-EARTH
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BUZZING WITH IDEAS

Tessie Revivis gives Electron and Beeb learners a flying start with an animation program that uses sound

ONCE the computer has been in your home for a few days and its keyboard mastered – or at least some confidence gained in using it – and the Welcome cassette worn out, the desire to produce your own program sets in. The programming task you set about will depend on your own inclination: you might like to incorporate the recipe book onto a tape, the secrets of the home brew or a pigeon-fancier's diary and your kids – well, Super Space Invaders Mark XI will suffice. Whatever target is chosen, all programs will, surprisingly, follow essentially the same general rules. In fact, almost every program you write will in verbal terms look a little like this:

Set all variables
Set up screen
Print information
Get information
Update items
If finished end
If not finished start again

As you can see from this list the rules are very general, but they provide a sound basis to expand from. The order might vary. For example, you might wish to set up the screen display before setting up variables or get information before printing any information to the screen, and so on.

If you have read through other pages in *Acorn User* (and I strongly suggest you do even if you don't fully understand – that will come in time) you'll have come across the term 'structured' programming, which simply means programming with a bit of thought or presenting your program neatly and logically. The list above, though very general, is an example of structured programming: simple, clear and logical.

Let's turn our hand now to writing a short program that uses a number of the facilities available on the Electron. The program is simple, but provides easy animation and sound and can be stopped at any time just by hitting the space bar. The idea is that we get a fly to buzz to and fro across the top of the screen and when the space bar is pressed it crashes to the floor with a thud!

Before starting we need to think about our requirements. Most obviously we need the fly. To keep everything nice and simple we'll use the common or garden asterisk (*) to represent this. The easiest way to provide animation is to use the PRINT statement to put the asterisk on the screen, rub it out and then print it in the next location along the screen, thus providing the illusion of movement. To make this easier a special print positioning command is available in BBC Basic. This is the TAB (short for tabulation) command.

TAB treats the screen like a sheet of squared paper divided into rows and columns, the first column and first row being at the top left hand corner of the screen. In computer terms this is referred to as column 0, row 0 rather than column 1, row 1. Instead of using the long-winded column and row references these numbers are placed in brackets. For example, to print an asterisk at column 5, row 2 (figure 1 overleaf) we would use:

```
PRINT TAB(5,2)"*"
```

To print a row of asterisks across the top of the screen the TAB routine can be placed inside a 'loop', which counts out the number of the columns. The actual number of the columns depends on the particular graphics screen chosen; we'll use the screen mode 0 as this is the biggest.

The short program to do this would be:

```
10 MODE 0
20 FOR column = 0 TO 79
30 PRINT TAB (column,3);"*";
40 NEXT loop
```

Here we have introduced a variable to keep count of the column, and to remind us of that fact I have called this variable column. The term variable implies its use, and it is really just a counter with a name. The count variable is used as one of the two values inside the TAB command. Each time the loop executes, column will have one added to it so that the PRINT command will TAB to the next column. The row count remains constant at 3 so that the asterisks are printed side-by-side across the screen.

The loop is controlled by line 20, 'FOR column = 0 TO 79', which causes the column variable to be incremented in steps of one from 0 up until 79. The incrementing process actually doesn't take place until the NEXT command is encountered in line 40, which makes the computer do all the instructions inside the command over again, providing of course the variable column has not reached the finish value of 79.

Rubbing out each asterisk is performed in a similar manner and within the same loop. All that needs to be done is to print a space over the old asterisk. Add the following lines:

```
32 FOR delay = 0 TO 50 : NEXT delay
34 PRINT TAB (column,3);" ";
```

Line 32 is called a delay loop; it performs no practical function other than to create a slight delay to slow things down. Line 34 prints the space that blots out the asterisk. Note as in line 30 above the use of the two semi-colons after the TAB command. These simply ensure that the computer keeps printing on the same line. Try playing around with loop values to see the effect of different values (the best way to learn computing is to experiment!).

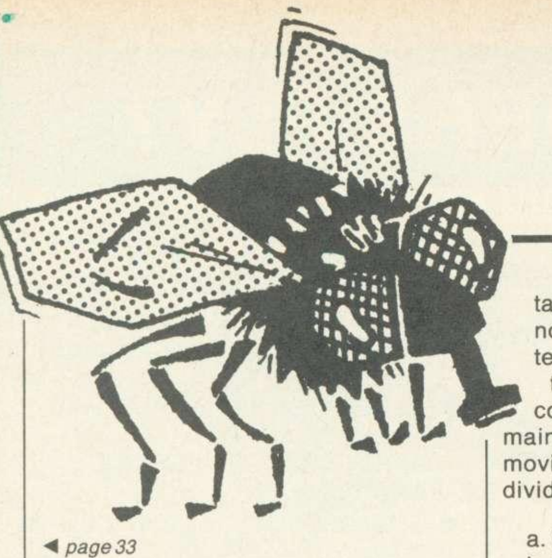
So far the fly just moves from left to right across the screen. To move from right to left, all we need do is get the printing loop to count down from 79 to 0.

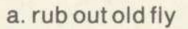
A fly tends to buzz, so some experimentation with the SOUND command should provide the right sort of noise. I found that the command

```
SOUND 0, -15,2,1
```

had the right effect. To get a continual buzz try placing this in a suitable position in the FOR . . . NEXT loop.

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◀ page 33

Our original idea was to kill the fly once the space bar was pressed. To do this we need to incorporate a keyboard test or scanning routine. Two lines are needed for this as follows:

```
36 key$ = INKEY$(0)
37 IF key$ = " " THEN END
```

Line 36 introduces a new type of variable, a string variable. String variables of this kind are used to hold a character (a keyboard character in this case) as opposed to a number. The INKEY$(0) command tells the computer to look at the keyboard very quickly, and if a key is pressed place its value in the variable key$. The next line, line 37, tests to see IF key$ equals a space THEN END. If keystring (key$) doesn't contain a space the loop will continue.

At the start of the article I laid out a general program instruction list and talked about structured programming. Much of what we have played around with so far hasn't been particularly well structured, but before writing the main program it is often useful either to think your ideas through or experiment at the keyboard in this manner. Let's now map out the Fly in the Sky program in a logical manner. Writing it down on paper we might end up with:

1. Set up MODE 0 screen
2. Set up move fly left to right loop
3. Do fly moving procedure
4. Set up move fly right to left loop
5. Do fly moving procedure
6. Repeat items 2, 3, 4 and 5 until fly is dead

Now we have the main program, albeit in words, needed to perform the task in hand. Or do we? There's no provision for the sound or key testing we have discussed. In fact, these items are minor and are considered as subsections of the main program. Consider item 2, the fly-moving procedure. This could be subdivided as follows:

a. Print fly
b. If space key tested then do die procedure
c. Make buzz sound
d. Do a delay loop
e. Rub out fly
f. Do items a,b,c,d, and e until complete

This list of items compares to the short lines of program we developed above. BBC Basic is unique in that groups of statements can be enclosed inside a special program casing called a procedure that can be given a name and placed outside the main program. A typical program containing a procedure might go like this:

```
10 PROCdemo
20 END
30 :
40 DEF PROCdemo
50 PRINT "This is a demo"
60 ENDPROC
```

Enter this and run it. As you can see, the procedure is called PROC in Basic and is also given its own unique name, thus the command PROCdemo will cause the commands inside the procedure PROCdemo to be executed. The procedure itself is prefixed by a special command DEF, which is shorthand for define.

The procedure must also be terminated by another new command, ENDPROC (end procedure).

We need to incorporate another procedure in the program that will be executed if the space bar is detected being pressed. PROCdie might be written like this:

a. rub out old fly
b. do a dying fly sound
c. print fly one line down
d. do a delay
e. rub out old fly
f. do b,c,d and e until fly hits the floor
g. do fly hitting floor sound
h. end fly die procedure

Now we have a main program and two procedures. We know exactly what our program needs to do and how it performs it without so much as writing a single Basic command, apart from a bit of early experimentation. Get into the habit of doing things this way; it may seem long-winded at first, but I can assure you virtually all professional programmers write their programs in this way. Sitting down directly at the computer and writing Basic off the top of your head leads to a bad programming technique and it is frustrating when the program doesn't work correctly (as I've proved many times).



Finally, the program (listing 1). Look carefully at it, trying to pick out the structure within it and how the commands relate to the list we constructed earlier. You might not recognise several of the commands so get your *User Guide* out and find out exactly what they do. If you are still not sure try experimenting with them to see the effects that different values have. Programming is all about practice and experimentation.

The 'Fly in the Sky' demonstration program (listing 1) appears on yellow page iii

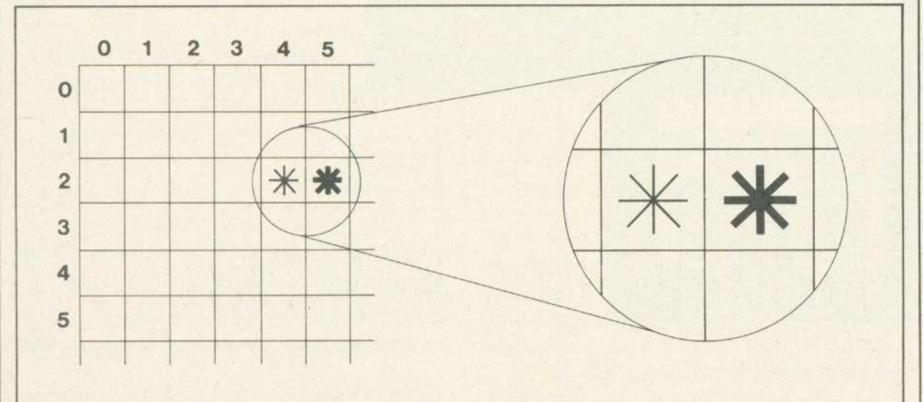


Figure 1. The fly (represented by an asterisk) is 'moved' across the screen by being printed and then rubbed out in each column consecutively



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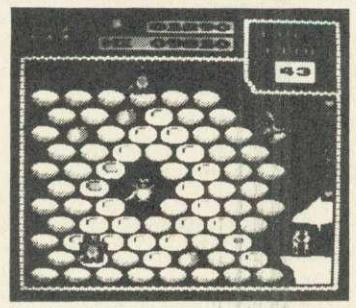
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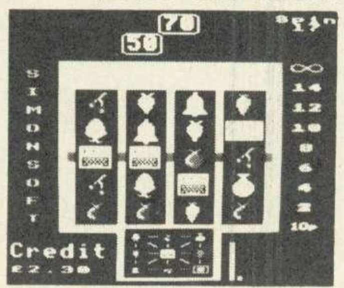


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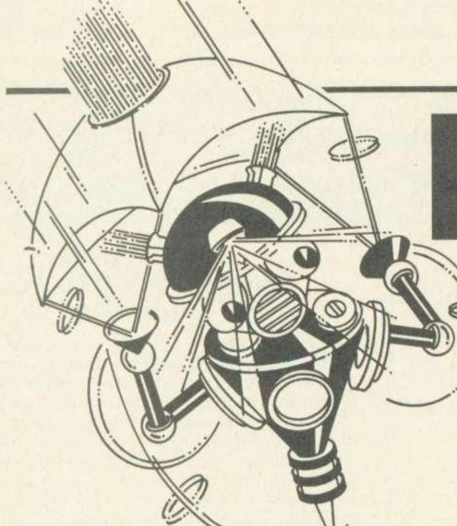
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PARANOIDS DROP IN

Michael Why's zappy game is also an easy way to learn procedures

THE idea for *Paranoids* came to me while I was watching a horror film. I wanted to give the user a non-stop game in which he would have to have his wits about him all the time so as not to lose interest.

The game starts off with three Paranoids (Paras for short) coming down from the top of the screen and you have to shoot them with your laser-powered tank before you pass on to the next level. On this level four Paras descend and when you've shot them, five – and so on. If a Para lands before you can shoot him you will lose a life, and the game is over when you lose three lives, and your final score will be displayed.

The game is played on just three keys. Left and right movement of the tank is controlled by the Z and X keys respectively. The tank's laser cannon is fired by the space bar.

The game was written on an Electron but it is compatible with the Beeb. I started the project by drawing up a flow-chart (figure 1). This is an essential part of designing a program, as it sets out the whole structure. My next step was to construct a variables table (figure 2). As you can see, all the names mean something to the programmer and are built up in such a way as to remind him what he is doing – thus cutting down on debugging the program.

Next I wrote down the program on coding paper, which is divided into rows and columns, one character per block. The point here is that it helps speed the completion of the program. In fact I wrote down only the main part of the program, for if the main structure doesn't work there is not much point in adding instructions, sound and colour etc.

This is how the program is structured, with a breakdown of the procedures:

PROCINIT defines characters, variables and also turns off the text cursor. This procedure also defines whether the Para will come straight down, from the left or from the right. It also sets up PARA$(1), PARA$(2) etc. depending upon how many Paras are to come down.

PROCTANK checks to see if the HOLD key has been pressed. If it has then it sets up a simple REPEAT . . . UNTIL loop. When the X key is pressed it ceases to continue. This procedure also checks if the left or right key has been pressed; if either has then it is acted upon and produces a sound.

PROCPARAS is the most important procedure in that, as the name suggests, it moves the Paras and checks if they have landed or reached either side of the screen. In the procedure is a loop which moves PARA$(1), PARA$(2) etc (depending on the size of the loop) one position. The Paras can only move between columns 3 and 35 of the screen; if they move outside these limits they reappear on the other side of the screen. So if a Para reaches column 35, its X position is made equal to 3 and it reappears on the left-hand side. Similarly, if the Para tries to move into column 2 its X position is changed to 35 and the Para turns up on the right-hand side. Each time through the loop in PROCPARAS the flow of the program branches to PROCFIRE, a procedure which checks to see if the space bar has been pressed. If it has not it returns to PROCPARAS. If it has a sound is produced and the laser is drawn. If while shooting, the PARAX% position is the same as the FIREX% position the laser must have hit the Para so PROCXPLODE is called up. This then prints an explosion over the Para, a delay occurs and a space is printed over the Para and a sound produced. Line 850 is the most important line as the increment that is used to make the Para move is then made equal to zero, also PARAX% and PARAY% are then made equal to 3 and 2 respectively. This means that the Para is stored as TAB (3,2). At this point the laser from the tank is unable to reach across this far, so giving the impression that the Para is no longer there.

PROCLEVEL increases the loop in PROCPARAS so that if five Paras came down previously then six will now come down.

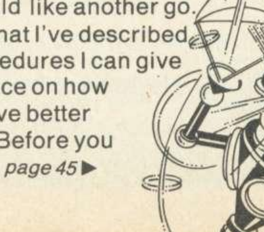
PROCNEW-LIFE comes into action when a Para lands (which is checked in PROCPARAS). If LIVES% = 3 then three lives have been lost and your game is over. If LIFE% = 1 it goes to PROCTANK-LOST.

PROCTANK-LOST prints out "LIFE LOST" with a short beep and delay between each letter.

PROCGAME-LOST prints up your final score and asks if you would like another go.

Now that I've described the procedures I can give you advice on how to achieve better scores. Before you

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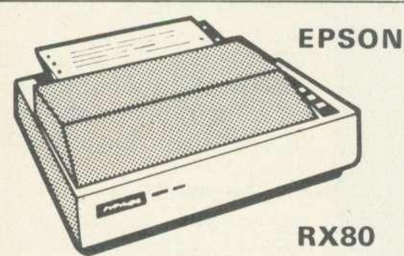
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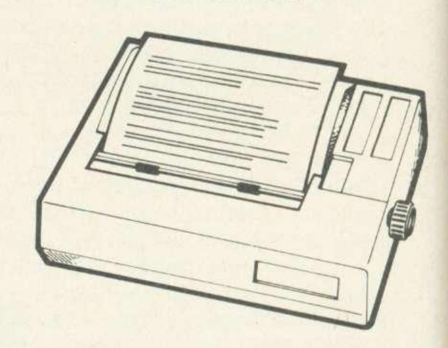
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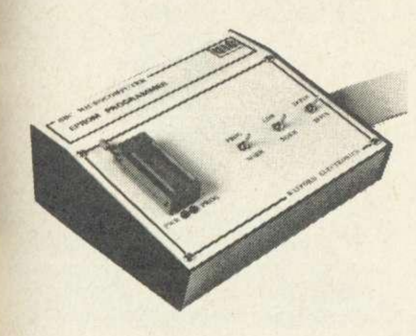
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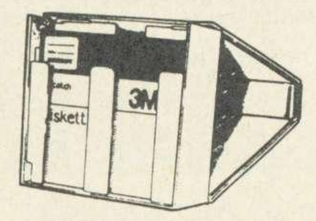
EPROMs need careful treatment to survive their expected lifetime. Rushing it could burn their brains out. So cop-out of this helter-skelter world; take it easy the TEX way and give your chips a well earned break. Cool, gentle and affordable. EPROMPT does it properly.

Two versions available:

- **EPROMPT EB –** The standard version. Erases up to 16 chips. **£28.00**
- **EPROMPT GT –** Erases up to 28 chips. Has an incorporated safety switch which automatically switches off the UV lamp when the Eraser is opened. **£30.00**

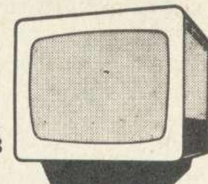
Spare 'UV' Lamp bulbs. **£9**

NEW DESIGN PLASTIC LIBRARY CASES



for Disc Storage 5¼" (holds 10) **£2**

MONITORS



- **MICROVITEC 1431** 14" Colour Monitor, RGB Input. (as used in BBC programmes) FREE Interface Lead. ONLY **£173**
- **MICROVITEC 1451** Hi-res 14" Monitor incl. lead **£295**
- **MICROVITEC 1441** Super Hi-res 14" Colour Monitor **£249**
- **KAGA** 12" Standard resolution colour MONITOR/COMPOSITE VIDEO **ONLY £195**
- **KAGA RGB** 12" Medium Resolution Colour **£195**
- **KAGA RGB** 12" High Resolution Colour **£259**
- **BNC** Connecting Lead **£3**
- **RGB** Connecting Lead **£5**
- **ZENITH 12"** High resolution, jitter free picture, Amber or Green **£75**

Carriage on Monitors £7 (Securicor)

5¼" DISKETTES

(Lifetime warranty)

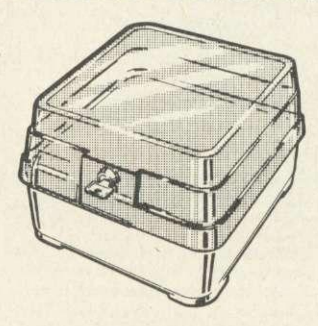
Why settle for less, Buy the best.

- 10 SCOTCH 3M Diskettes S/S S/D **£15**
- 10 SCOTCH 3M Diskettes S/S D/D **£17**
- 10 SCOTCH 3M Diskettes D/S D/D **£28**

DISC ALBUMS

Attractively finished in beige leatherlook vinyl. Stores, protects and displays 20 discs in double-sided clear view pockets. ONLY **£4.25**

LOCKABLE STORAGE UNITS



Attractively finished, strong beige plastic base fitted with dividers. Smoke acrylic top. Supplied with adhesive title strips for ease of filing.

- M-35 Holds upton 35 mini discs **£13**
- M-85 Holds upto 85 mini discs **£18**

FLOPPY HEAD CLEANER KIT

Unless your Office/Home is dust free, you should clean floppy-heads at least once a week to avoid the risk of cross contamination. Very simple to use. Only **£14**

MONITOR CRT SCREEN CLEANING KIT

The anti-static spray controls dangerous static charges on the screen surface and ensures its optical clarity. **£12**

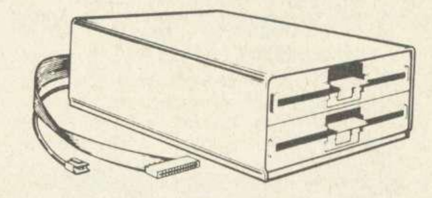
KEYBOARD CLEANING KIT **£16**

PRINTED CIRCUIT BOARD CLEANING & LUBRICATION KIT **£14**

DISC DRIVES CASED WITH CABLES (less PSU)

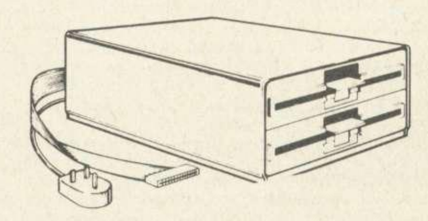
(All Drives are NEW SLIM-LINE Type)

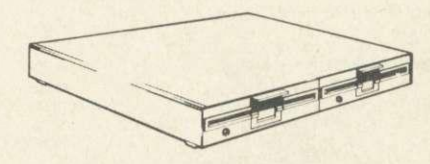
NEW LOW PRICES



- **CLS 100** Single, TEC Single sided 40 track 100K, 5¼" Disc Drive **£115**
- **CLS400** Single, Mitsubishi Double sided 80 track 400K, 5¼" Disc Drive **£165**
- **CLS400S** Single, Mitsubishi Double sided 40/80 track Switchable, 400K, 5¼" Disc Drive **£199**
- **CLD200** TEC Single sided 40 track 200K, twin 5¼" Drives **£225**
- **CLD800** Mitsubishi Double sided 80 track 800K, 5¼" TWIN Drives **£325**
- **CLD800S** Mitsubishi Double sided 40/80 track switchable, 800K, Drives **£249**

(CUMANA) DRIVES CASED WITH PSU & CABLES





- **CS100** TEC Single sided 40 track 100K 5¼" Single Disc Drive **£139**
- **CS200** TEC Single sided 80 track 200K 5¼" Single Disc Drive **£205**
- **CS400** Mitsubishi Double sided 80 track 400K 5¼" Single Drive **£225**
- **CD200** TEC Single sided 40 track 200K 5¼" TWIN Disc Drives **£245**
- **CD400** TEC Single sided 80 track 200K 5¼" TWIN Disc Drives **£365**
- **CD800** Mitsubishi Double sided 80 track 800K 5¼" TWIN Drives **£425**
- **CD800S** Mitsubishi Double sided 40/80 track Switchable 800K TWIN Drives **£465**
- SPARE DRIVE CABLES, SINGLE **£6;** DUAL **£8**
- DFS Manual (comprehensive) **£7.50** (No VAT)

P.S.

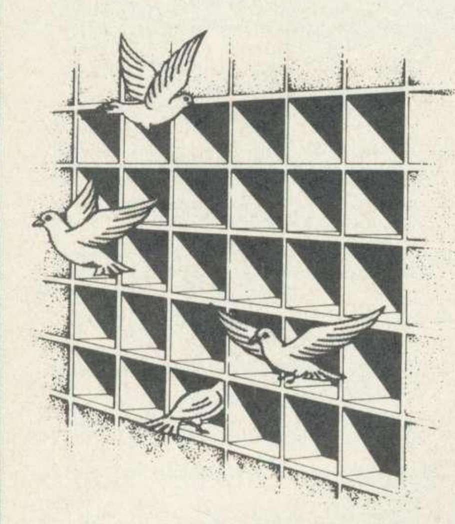
1. You do not require Formatting Discs when using our DFS as the formatting program is in the ROM, nor do you require expensive 40/80 track switchable drives as with our DFS you can read and write both 40 and 80 track discs in an 80 track drive (software switchable).

2. Our **MITSUBISHI** Slimline Disc Drives are Double Sided, Double Density, 1 Megabyte. Track density 96 TPI, track to track access time 3mSec. They are fast, efficient and highly reliable.

Continued →

WONDERFUL WATFORD

TWO DATABASE SOFTWARE for BBC MICRO



DISCDATA

At last for BBC Micro Disc users, Watford Electronics have produced 'DISCDATA' which must be the most versatile general database at the price on the market. The length of your files is restricted only by the space on your disc. You can have upto 20 fields with 'page' length records of upto 254 characters. The program is completely menu driven obviating reference to a manual although written guidance is given with the program. Add and delete records, amend title, field names and records, sort on any field and search for any record or group of records in any field. You do not need to abandon or rewrite your files if you wish to add additional fields or extend the length of any field, the program will rewrite the files for you. Your files can be in any drive. Output can be in 40, 80 or 132 character width with Printer routines. Two forms of output are provided for horizontal for label type output and a tabulated output with title and headings. What is more, the selected fields can be placed in any order on the screen. In the horizontal mode you can scan backwards or forwards with wrap around effect. Output can be started or stopped anywhere in the file. There is automatic totalling on decimal fields and an automatic count of the number of records output.
Now with extra 3 features: Allows string search; Calculations can be done on numeric fields; Create Sub-Files from the main File.

On disc at **Only £17**

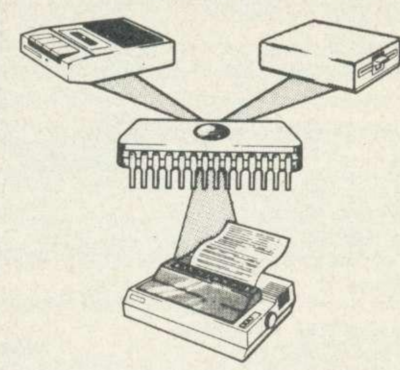
It has to be the best value.

FILE-PLUS

Now even more powerful with the added facility of a SHELL SORT on any field. This must make DATA-PLUS the most powerful and versatile Database to be found on BBC Micro.
A 16K ROM containing the most flexible and easy to use disk based Database system on the market. A database may occupy your total on-line storage capacity. You may design any number of data entry forms using a "paint" on screen technique. Forms may be upto 3 screens in size. A form may be used to Add, Delete, Update, Print and Spool records from your Database. Quick search facility on any text field. A query language provides full maths support (–, +, /, *, +-9999999999.9999) and compare facilities (=, >, <>, <=, >=, &, I) when used with the keywords – Assign, Compare, Display, End, Goto, Iff, Ift, Print, Read, Search, Spool and Update. Full printed output control via embeded commands. Supplied with 70 page manual and fitting instructions.

Only £43

BUFFER & BACKUP ROM



A very versatile firmware. An ideal ROM for engineers, programmers, teachers, students, etc.

★ Converts your Sideways RAM to a 4K or 16K BUFFER for a parallel printer. (Uses * FX5,3). (You no longer require to purchase expensive (£100+) Printer Buffers.)

★ Dumps selection of Disc files to Tape.

★ Makes backup copies of tapes onto Tape, Disc and Hobbit.

★ Displays contents of a chosen paged ROM on screen.

★ Menu display on 'shift-break' using ROM Filing System.

★ Comprehensive Manual

Simply a give away at **£22**

GEMINI'S BUSINESS SOFTWARE

Cashbook Accounts	£52
Final Accounts	£52
Invoices & Statements	£17.25
Commercial Accounts	£17.25
Mailing List	£17.25
Database	£17.25
Stock Control	£17.25
Home Accounts	£17.25
Beebcalc Spreadsheet Analysis	£17.25
Beebplot	£17.25
Payroll	£39

N.B. All the above Gemini software is on tape. For Disc Based (40/80 track) please add £3.

PEN PAL–VERSATILE LIGHT PEN SOFTWARE

- Enjoy, Explore, Educate!
- Pixil, Line, Character Definition
- Free hand drawing
- All Colours – MANY Special Effects
- Fill, Refill and Stripes
- User defined "Brushed Strokes" plus Character definer
- Grid, Scale, Perspective aids
- 2 TO 200 Points palletable in one Design with Circles and "RUBBER BANDING"
- Move design/character to any screen position
- Save and Load screens, User defined Graphics and line drawings for video titles, Own programmes, etc.
- Many Educational uses
- Instruction booklet included
- Full software support for "CUSTOM USE"
- Works with Watford, RH, Acorn User, DIY, and many other LIGHT PENS
- Available on DISC or TAPE

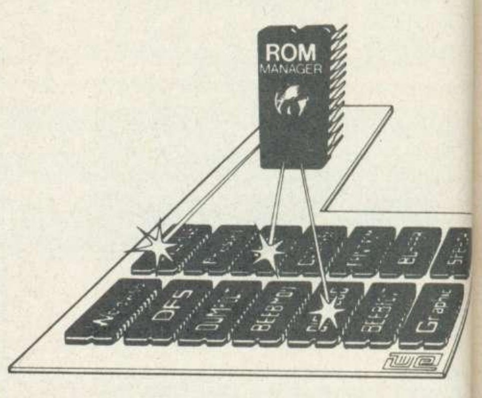
Price: Tape **£10;** Disc **£11**

DISC EXECUTOR

Disc Executor (our most popular software) is a highly sophisticated disc utility, which allows you to transfer all tape based software that we know of onto disc. You no longer have to throw away any of your cassette based software on acquiring a disc drive. It handles 'locked' programs and allows you to load full length adventure type programs (i.e. up to & 6E blocks) and programs that load below &E00. It is very simple to operate (full instructions supplied). It saves you your valuable time and money too. Our Disc executor is not a Replica, its the 'Real Thing'.
Available in both 40 and 80 track discs. Please specify when ordering.

Only: **£10**

ROM MANAGER



This unique piece of firmware has been designed to allow the USER to access the BBC Micro's Sideways Rom Paging facility to the full. The 18 Commands our ROM MANAGER adds to your computer are concerned with 3 aspects of ROM use:

1. ROM CONTROL – Ability to activate at random any of the ROMs present in the Micro.
2. BBC MICRO's STATUS – e.g. Checksum on any ROM, and the Filing system currently active.
3. ROM DEVELOPMENT – Allows main memory to be used like Sideways RAM.

The Commands available are:
***CHECKSUM** – generates a CRC for the specified ROM.
***DIRECT** – allows you to pass a particular command to the specified ROM.
***EXAMINE** – allows examination of the named ROM.
***EXPLAIN** – gives detailed description of the first 22 FX codes.
***FILE** – passes the command directly to the currently selected filing system.
***FUNCTION** – displays the string currently programmed onto the function keys.
***INCLUDE** – allows he main memory to be used for developing ROM software without need to purchase expensive sideways RAM.
***MODIFY** – any location in memory is displayed and can be modified with this command.
***NAMES** – displays the names of any resident ROMs.
***RAM** – allows the command to be passed directly to the 'RAM based ROM'.
***REMOVE** – turns off the 'RAM based ROM' option.
***SPECIFY and *DEFAULT** – specifies the default ROM and passes the named command to the default ROM specified.
***STOP and *START** – allows the named ROM to be disabled or enabled, preventing clashes between ROMs.
***STATUS** – provides information about the ROMs inside the BBC micro, including the socket number, the name of the ROM, its length, whether or not it is enabled and supports language or service entry points.
***VALUES** – outputs information concerning the status of ROM MANAGER e.g. the socket number it occupies, the number of active ROMs with a higher priority than itself, the current filing system.
***VECTOR** – the same function as *DIRECT, but provided in case *DIRECT clashes with other ROMs.
In our opinion this ROM is one of the most useful utility ROMs available on the market, and is a must for anyone using ROM based software.

Price: **Only £21**

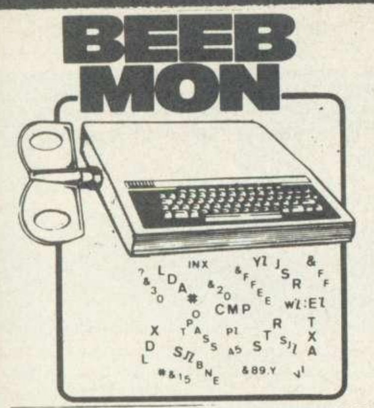
ADE

The complete program development package on 16K ROM. A must for all the Assembly Language Programmers.

SPECIAL OFFER **£49**

ACCESS HOT LINE

Tel: 0923 50234



Watford's own Machine code Monitor ROM written by Andrew Bray (Cambridge), co-author of the BBC Micro Advance User Guide.

The most powerful and versatile machine code monitor ROM yet written for BBC Micro. It has all the normal memory editing, moving and relocating facilities, plus all editing is with a full screen editor allowing scrolling up and down memory, entering in Hex, ASCII or standard assembler mnemonics.
In use as a debugging tool, you run code under a total emulation system. Everfelt a desperate urge to set a break point in ROM? No problem – you can even have breakpoint on reading or writing locations in memory and on register contents. The system fully supports debugging of sideways ROMs e.g. BASIC can fully and easily be run from within Beebmon and from there DFS and other sideways ROMs can be used in total emulation mode.
Beebmon can even run itself. In so doing you can nest Beebmon up to a level limited only by the memory size. Beebmon uses 256 bytes of workspace, located anywhere in memory, even on the 1MHz Bus. Beebmon effectively uses no zero page workspace, so your program (e.g. BASIC) can use any or all of the base page. How does it achieve this? By providing a 6502 interpreter all programs running under it exist in a virtual BBC, so special memory locations like the ROM latch are not actually accessed by your programs, instead they alter a location in Beebmon's workspace. Emulation also allows immediate return to Beebmon command level by ctrl-escape no matter what code is being excuted at the time. All this exceptional power and flexibility is complemented by a clear and detailed manual included in a value for money price of:

£22



Discover the hidden secrets of BASIC and the OPERATING SYSTEM with this easy to use programmers tool.
A ROM based machine code Disassembler for the BBC micro. It enables machine code programs to be listed in BASIC/DUMP format and thus is the perfect complement to the built in assembler. It allows Sideways ROMs, files on disk or tape to be listed, and also has a comprehensive editor, allowing mnemonics to be altered directly, as well as HEX, DECIMAL, ASCII and BINARY memory editing. There is also a full set of labelling facilities available (up to 3,200 labels), with the major locations and routines already labelled.
Thus DIS-ASM enables any monitor program, such as BEEBMON to be used to much greater effect as it is not necessary to disassemble memory each time the display is altered.

ONLY **£18**

WATFORD – Always a step ahead

COMPUTER CONCEPT'S ROMS

CARETAKER Basic Utility	£28
Graphics ROM	£28
Disc Doctor ROM	£28

Wordwise

Without doubt a very sophisticated piece of software for the BBC Micro. It has all the features of a professional word processor yet is easy to use.

SPECIAL OFFER THIS MONTH: **£32**

THE INVESTIGATOR

Now you can make up back-up copies of all your Discs. Put the precious originals away in the safe and use your duplicates.
See what your 8271 can do! With Watford's Investigator you can find out about track formatting, sector length, etc. Investigate your disc and then make up your back-up copy.
Disc based software includes a comprehensive manual.

Price: **£15**

(Please specify 40 or 80 track when ordering)

LIGHT PEN for BBC Micro



This versatile lightpen is very easy to use. It allows you free hand drawing in all colours. Has Special effects facility and many educational uses. An ideal and easy way of communicating with Micros for Children.

Only: **£20**

(Price includes our highly sophisticated PENPAL Lightpen software on Cassette. Please add £2 for software on Disc)

GAMES SOFTWARE

ADVENTURE QUEST (L.9)	£8.50
COLOSSAL ADVENTURE (L.9)	£8.65
CHESS	£6.95
CHUCKIE EGG	£7.90
CRAWLER (WESOFT)	£5.00
CROACKER	£6.95
DUNGEON ADVENTURE (L.9)	£8.50
Escape from MOONBASE ALPHA	£6.95
FELIX in the FACTORY	£6.95
GALACTIC COMMANDER	£6.95
KILLER GORILLA	£6.95
MUNCHYMAN	£5.95
MOONRAIDER	£6.95
MUSIC SYNTHESISER	£8.25
PENGO (Watford)	£6.95
SNOWBALL (L.9)	£8.50
SWOOP	£6.95
Twin Kingdom Valley	£8.25
747 FLIGHT SIMULATOR	£7.75

NEW LAUNCH

Waford Electronics' 32K RAM EXPANSION BOARD FOR THE BBC MICROCOMPUTER

Now Watford Electronics brings you the latest state-of-the-art memory expansion board for your BBC microcomputer. This compact board which fits inside the computer does not just give you 16K or even 20K of extra RAM, but a massive **32K!!!**

There are many useful facilities available with this board:

- The top 20K of the expansion RAM can be used as the screen display memory, leaving all the standard BBC RAM free for programs or data storage. This allows good graphics and long programs to be combined. For instance you could have MODE 0/1/2 GRAPHICS AND 28K OF PROGRAM SPACE. The extra memory can be used by virtually any language or utility such as BASIC, VIEW, WORDWISE, etc.
- The full 32K or the bottom 12K of the expansion RAM can be used as a buffer for the printer, sound channels, RS423, keyboard or speech synthesiser. This allows very long text files to be printed while you are using 27K of program and 20K of graphics!
- This board is the ideal complement to any word processing system. There is no need to wait for slow printers as you can type in long text in 80 column display mode while printing is going on – TWO JOBS DONE SIMULTANEOUSLY!!! (an equivalent printer buffer would cost you £115+).
- The board is compatible with a vast range of software and hardware available for the BBC microcomputer, including our ROM expansion board and double density DFS.
- The board is extremely easy to fit. It is supplied complete with a comprehensive manual and ROM based software with full *HELP messages.

SPECIAL INTRODUCTORY OFFER
Only: £79 (carr. £1)

GRAPH PAD

With this popular British Micro's Graph-pad, you can add new dimension to your computer enjoyment. It helps you to create your own application programs by the simple use of the Graphpad. Ideal for Educational use. Supplied complete with Cables, Manual and a two program cassette.

Price: **£115**

SURGE PROTECTOR Plug

Safely eliminates dangerous voltage surges. During a thunderstorm, a nearby lightning strike can induce high voltage spikes in the voltage supply or fluctuating loads can also result in transient overvoltages which if unchecked, lead to expensive data corruption/loss. Our surge protection plug will provide the necessary surge protection. Simply replace your standard 13Amp mains plug with the surge protection plug (which is almost the same size). Ideal for computers, Hi-Fi systems, precision instruments, fridge freezers, etc. Max. surge current 2KAmp; Max. Voltage 250 Volts.
A must for all serious computer users.

Price: **£8.95**

WATFORD ELECTRONICS

Continued →

MK 2 13 ROM SOCKET

EXPANSION BOARD

Now all lines fully buffered – On board battery back-up facility – will now accept EPROMS 2716, 2732, 2764 & 27128 and ROMs 6116 & 6264.

Simply plugs into one of the four ROM sockets currently available in BBC Micro. There are only 5 solder connections to be made. Full instructions are supplied. This board has been ergonomically designed to enable the user, easy further expansion inside the Micro, e.g. Double Density Board, Torch Board, etc. (At Watford, we think ahead.)

Our Mk2 13 ROM Socket Board enables the User to increase the sideways ROM capacity from the basic 4 sockets upto full 16 capable of being supported by current operating systems. In addition the board is designed with the facility to hold upto 16K RAM, which when switched into operation is automatically selected by any WRITE signal to the Sideways ROM area. This gives the User the ability to write a utility or language and upon pressing break have the utility or language up and running (new ROM software can be developed and tested in situ.)

The Board gives the User, plenty of freedom to explore the possibilities of the new paged ROMs due in the coming months and offers them the chance to develop their own.

All lines are fully buffered and the Board meets or exceeds all timings for operation in the BBC Microcomputer. When fully populated, the ROM Board consumes less than half the recommended maximum current limit.

Supplied ready-built and tested complete with fitting instructions.

ONLY £32.50 (carr. £1)

Versatile **BEEB SPEECH SYNTHESISER** Unit



SIMPLY the best! – An unlimited speech synthesis system. Complete with easy-to-follow manual. Controlling software is in ROM so no Cassette Loading problems!

PHONEMES for word synthesis – That means unlimited vocabulary! No extra speech dictionary chips to buy!

BUILT-in Library of approximately 500 words to get you started.

ENGLISH accent – Utilises inflexion techniques to produce highly comprehensible speech.

EASY to use system – Just plug the software ROM into a socket, the Speech unit into the User Port, and away you go! No specialised 'dealer upgrade' required!

COMPACT unit – The whole system is built into a small case – easily tucked behind the computer. Auxillary output socket provided for direct connection to an external amplifier.

HOURS of fun! – Suitable for any application – Games, Educational Programs, Specialised Packages.

We know this all seems to good to be true but DON'T BE LEFT SPEECHLESS! Order your Versatile Speech Unit now!

Only £44

WATFORD'S LAUNCH OF THE YEAR APEX

The ultimate expansion system for the BBC microcomputer. It enables you to increase memory capacity to 2+/MEGABYTES including BATTERY BACKED-UP RAM.

The system consists of a mother board which fits inside the BBC and further daughter cards can be connected externally.

The internal card has the following features:

- 15 ROM/RAM sockets, 11 of which can be configured as 2716, 2732, 2764, 27128 EPROMS or ROM equivalent devices or as 6264 RAMs. Any RAM is Automatically battery backed-up and it's contents preserved when the power is turned off.
- The battery is recharged every time the machine is turned on and lasts several months, depending on the number of RAMs fitted.
- There is very little extra current drain, even with a fully loaded board as only the presently active ROM is powered up. In fact the fully populated board uses only 300/mA.
- The board reduces micro bus loading by up to three ROM loads, which improves reliability and performance.
- Installation is extremely simple. There is no soldering required. The board is rigidly held by two 40 pin sockets and five support posts.

A ribbon cable can be brought outside the computer and up to 8 external cards added. This enables the user to plug-in up to 142 paged ROMs. The cards have following features:

- Each card can accommodate up to 16 devices each of which can be configured as 2716, 2732, 2764, 27128 ROMs or 6264 8K RAMs.
- Battery backup is provided from the internal card.
- Only the active ROM is powered up permitting many external ROMs to be added with very little current loading (/100/mA per card/).

The system comes with controlling software in ROM. The utilities supplied are as follows:

- APEX – replies with the device number currently being accessed.
- APEX C – toggles between the colour and standard black and white messages.
- AL – loads from any device, regardless of the data type.
- AS – saves memory to any specified RAM device.
- AD – prints a directory of the devices present in the system, i.e. ROMs present and files stored. This also reports on the amount of free storage space.
- AF – asks for the free RAM devices.
- LA – repeats the last command to paged ROMs.
- AT – enters a memory testing routine. This will write a test pattern into the memory and read it back out again. If a fault is found, it is reported to the user. This test continues until Escape is pressed.
- RDISC – activates APEX as a filing system which then treats all free APEX RAM in the system as a continuous 'RAM-DISC'. All commands have similar format to the DFS and transfer is possible between the two systems.

The complete computer system bus is available to the user, so that other cards/devices could be added such as EPROM programmers, second processors, Winchester disc drives, clocks, etc. By racking the cards you eliminate the tangled mass of cables that usually accumulates around the micro.

A comprehensive operating manual is supplied with every APEX Board. Please write in for further details and prices.

BEEBFONT ROM

BEEBFONT is a remarkable new concept in BBC software, exclusively available from Watford. Once fitted, the 16K ROM will enable you to produce attractive text displays in following different styles:

★ **It works in modes 0, 1, 2, 4, using full colour.**

★ Simply use Ctrl–V to select the font and all further screen output will be in a new style.

★ Even the ordinary Beeb character set can be enhanced by doubling height or width and emphasising to give bold print.

★ A comprehensive editor is included which enables the user to design his own characters.

★ A spooling program is provided, which enables pre-formatted text files to be displayed on an EPSON FX, RX, and NEC Printers, using the full range of character styles. (Please specify printer type when ordering). Can be used with WORDWISE.

★ This really must be one of the most original and exciting products of the year.

★ A twenty page manual is provided and the demo/editor software comes on disc or cassette (please specify when ordering). **ONLY £39**

THE ULTIMATE DFS FOR BBC MICRO

by

Watford Electronics

Highly acclaimed at The ACORN and BBC MICRO USER Shows. What do the independent press say?

Good value for money – *Beebug Aug. '83*

A very worthwhile package – *The Micro User*

You'll be buying a very powerful package – *Personal Computer News*

Superior DFS; Excellent disc sector editor – *Computer Answers*

Without a doubt, the most sophisticated DFS Software yet written for BBC Micro Computer. This powerful new DFS is fully compatible with ACORN DFS yet has much increased power due to additions, carefully designed to make life easier in normal use. It consists of over 14K of efficiently written machine code. It is entirely self contained and so does not require a utilities disc to function.

Please write in for full technical specification.

PRICES:

DFS (Disc Filing System) ROM **£29**

Complete Disc Interface Kit including DFS ROM & Fitting instructions £99

Disc Filing System Manual. Comprehensive and clearly written £7.50 (no VAT)

P.S. We will exchange your existing ACORN DFS or PACE (AMCOM) DFS for Watford's highly sophisticated 16K DFS ROM for **£25**

Watford's DFS is exclusively available from Watford Electronics. We do NOT retail through any dealers. Every ROM carries a label with our LOGO and a serial number.

Now available:
Acorn DFS Kit **£95**

EPROMs & CMOS RAMs

2764-250nS (8K ROM)	**£5.95**
27128-250nS (16K ROM)	**£24.00**
6116-150nS (2K RAM Low Power)	**£5.75**
6264-150nS (8K RAM Low Power)	**£28**

WATFORD'S BEEB PRINTER ROM



Are you fed up with not being able to unravel your printer manual and use all those features you paid for? Need sensible paging for use in the creation of booklets? Then you certainly need our Beeb Printer ROM.
A machine code printer utility in ROM.

- 'Single' key operations replace control code sequences for underline, font and size selection, paper movement, etc. Up to 30 come pre-defined, without effecting normal fn key usage.
- **This rom allows easy control of your printer from 'Within' WORDWISE text. Instead of long escape sequences, you just 'OC' a single number to Select, Underline, Print Styles, etc.**
- Automatic fanfold page margins. Puts gaps in listings. PRINTed text etc to skip the folds. The gap size alternates to minimise paper wastage when using binders.
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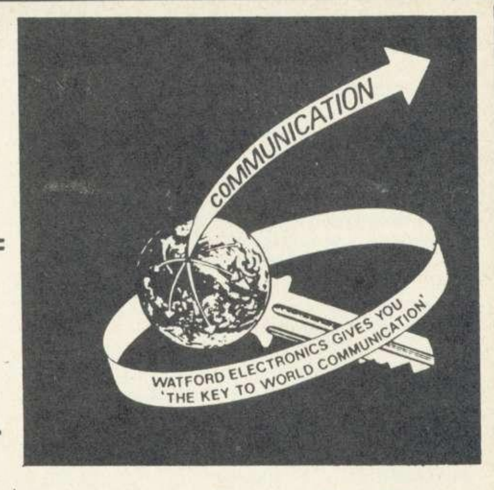
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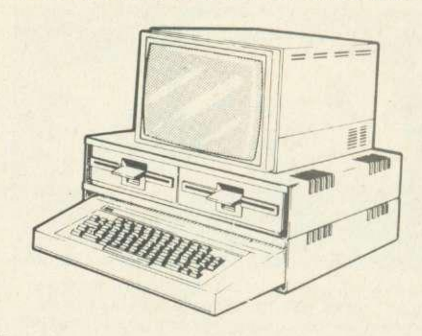
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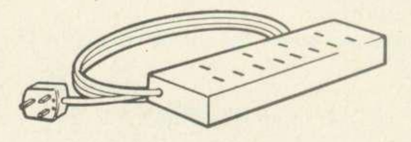
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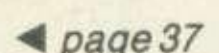
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◀ page 37

actually play the game watch how it works. You'll then have an idea as to how the Paras reach one side of the screen and then reappear on the other side.

Press ESCAPE and run the program again, this time taking up your position to shoot the Paras. Move one space in front of the target so that, if the Para is coming down from the right, you position yourself one space to the left and keep your finger on the fire button.

BLAT!

As you progress you'll find that it takes longer for it to register when you hit a Para. This is because in PROCPARAS more and more Paras come down as the loop gets bigger. The Para you hit may be PARA$(16). This means that it will have to go through the loop 16 times before it registers. You might find this frustrating but it adds to the fun of the game and would be too easy if it registered as soon as the laser hit the Para.

I hope you enjoy playing *Paranoids* and beat my own highest score, which was 11,850 on level 19 (on an Electron).

Turn to yellow pages iii and iv for the paranoids program

INTEGER VARIABLES	FUNCTION
LIFE%	Registers whether a Para lands.
LIVES%	A counter for the number of lives lost.
HIT%	Adds up the number of Paras hit.
LAND%	Adds up the number of times a Para has landed.
PARA%	Increases as the number of Paras increases.
T%	Current X co-ordinate of tank.
SCORE%	Current score.
LEVEL%	Current level.
L%	General-purpose loop counter.
FIREX%	For calculating the position of the laser.
FIRE%	The actual calculated laser position.
P%	The pitch used in PROCFANFARE.
D%	The duration used in PROCFANFARE.
STRINGS	**FUNCTION**
SPACE$	Used to cover a Para when it is moved or hit.
explode$	The explosion used when a Para has been hit.
tank$	The character used for the tank.
A$	Used for producing the beeps when a life has been lost.
ARRAYS	**FUNCTION**
PARAX%(30)	Current X position of the Para.
PARAY%(30)	Current Y position of the Para.
X%(30)	The X increment when moving the Para.
Y%(30)	The Y increment when moving the Para.
PARA$(30)	The Paras' actual character.

Start
Set up variables (PROC INIT)
Move Tank (PROCTANK)
Move Paras (PROCPARAS)
Check for fire
Has a Para been hit? — Yes → Increase score; No
Has a Para landed? — Yes → Decrease score → Decrease lives; No
Have 3 lives been lost? — Yes; No
Have all Paras been hit? — Yes → Increase number of Paras; No
Display final score
Another go (Y/N)? — Yes; No
End

Figure 1. Flow-chart of the action in the 'Paranoids' program (above)

Figure 2. Variables table for 'Paranoids' (left)


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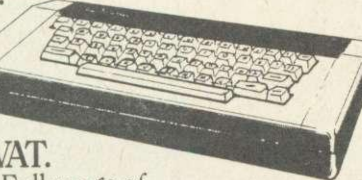
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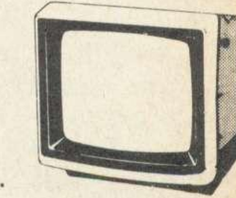
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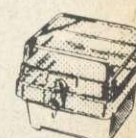


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Separate versions of the program are available for cassette and disc based systems. The disc version uses random access files to maximise record storage.

One extra feature of the disc version is that it provides limited spreadsheet facilities.

Spellcheck

SPELLCHECK is menu driven, and is the ideal companion for WORDWISE or VIEW. It provides an automatic spelling check for letters or documents.

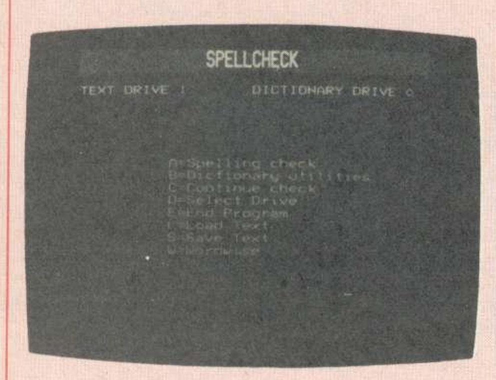
It is supplied with a dictionary disc already containing 6000 words, which may be increased to a maximum of about 17,000 words on a 100k disc.

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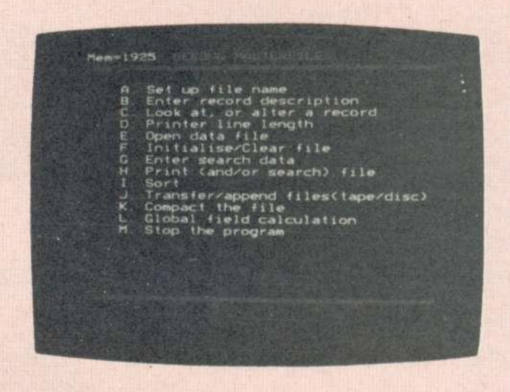
SPELLCHECK is menu driven, and is very simple to use, allowing unknown words to be added to the dictionary, ignored or re-spelt.

Incorrectly spelt words may be instantly respelt and a correct version of the document filed away, ready for printing or later use.

Dictionary discs for foreign languages may easily be created to help check letters sent abroad.



"…. I found the program to be invaluable…. fast and reliable …. a worthwile investment."
PCN FEBRUARY 1984



TECHNICAL INFORMATION

The cassette version will allow up to 10 fields to be specified per record. Any number of files may be set up, and each file may hold about 110 records (based on a typical 5 field record).

The disc version allows up to 17 fields per record, and the only limitation as to the number of records, is the capacity of the disc. Typically, using 5 fields, about 2000 records may be stored on a 100k disc.

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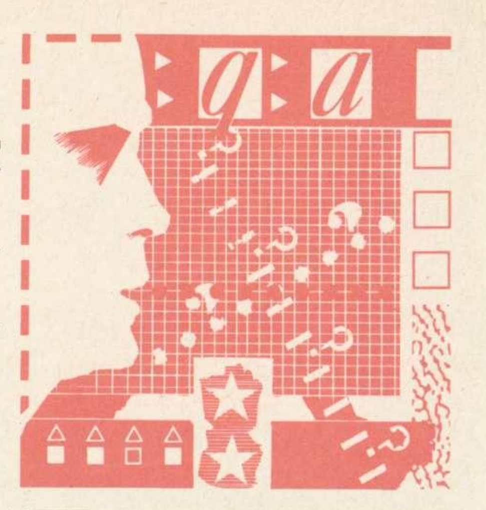
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£5 Stepping through a listing

BEING able to slow listings down or stop them when the screen scrolls is obviously a useful facility. The easiest way to do this is to put the computer into what is called 'page mode'. This is done by keeping the control key pressed while the letter 'N' is pressed (usually this is referred to as CTRL-N). This will stop the computer listing a whole program without stopping. The computer stops when about two-thirds of the screen is full of information, and the next part of the listing will only appear when the SHIFT key is pressed. To switch page mode off, it is necessary to use CTRL-O.

However, when checking a long listing, page mode is not the complete answer. Paul Holgate has sent a useful function key definition program (listing 1) that allows the user to step through a program a few lines at a time. When function key f0 is pressed, a list command is inserted into the function key buffer and the screen cleared. It will list a group of lines in multiples of 10 from 0 to 9 each time key f0 is pressed. The start line number is held in the integer variable L%, and this is incremented each time the key is pressed. To enable any starting point to be used for listing, key f1 has been defined to input the start point from where the listing is to run. Key f1 must be used before attempting to step through a listing. The usual start point will be at line 10, although listings can start at line 0.

This routine could be modified to step back through the listing by defining another key similarly, but *decreasing* L% by 10 each time the key is pressed.

Essential brackets

I AM indebted to Paul Holgate for also supplying the following item. There are cases where opening brackets are actually part of the Basic keyword. With such keywords, the inclusion of brackets is essential. Also there must be no space between the keyword and the bracket.

The following keywords require brackets:

RND	LEFT$	MID$	RIGHT$
STRING$	INSTR	POINT	TAB

Brackets may be omitted after the following keywords:

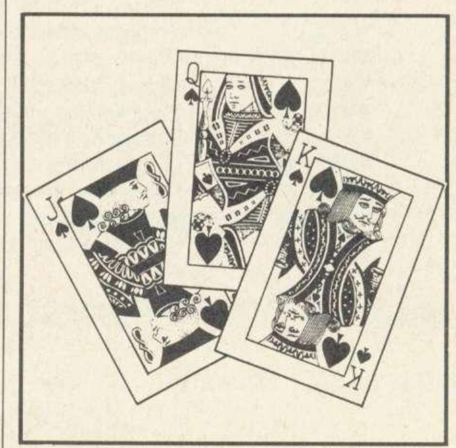
ABS	ADVAL	ASC	CHR$
EVAL	EXP	INKEY	INKEY$
INT	LEN	OPENIN	OPENOUT
SGN	SPC	STR$	USR
VAL			

Brackets may also be omitted from the mathematical keywords:

ACS	ASN	ATN	COS
DEG	LN	LOG	RAD
SIN	SQR	TAN	

Random numbers with strings

I WAS interested to see the routine for obtaining a 'perfect' sequence of 10 random numbers with no repeats in June's Beeb Forum (page 57). It occurred to me that the string functions could be used to perform a similar task. BBC Basic has quite a useful range of string-handling routines, many of which are underused.



The ideal method for card games . . .

See yellow pages v and vi for all programs relating to this section

Listing 2 shows my method. It is shorter than the Beeb Forum listing, which for the sake of completeness is repeated (listing 3). To my surprise, it is also on average 10 times as fast! Speed of performance was rather difficult to measure, as each run varied considerably depending on the luck of the draw. I therefore ran each routine 100 times to find the total time taken.

Listing 4 is included to show the idea for those interested.

This way of selecting a random sequence would be ideal in card games, as it is easy to include the jack, queen and king.

Listing 5 shows how this could be done. Notice that in line 80 the test to see if the number is already present includes the following space. This overcomes a problem that the test does not recognise the actual number but just a digit. In this example we need to include a 10.

The test as it stands in listing 2 will see a 1 present when it is meant to be a 10. The inclusion of the following space in the test prevents this from happening.

Listing 6 shows how the technique can then be extended to a full pack of cards. Surprisingly, it takes only some 5–10 seconds to select a full pack.

I hope these short programs will make readers take another look at strings and their possible uses, and maybe those who discover novel string applications will be prompted to send them in.

page 51 ▶

IF YOU have a technical hitch or a programming problem let Martin Phillips give his diagnosis. We'll pay £5 if you raise a really interesting point. Please give full details of the system you're using and include a listing where appropriate, making your question as specific as possible. WRITE TO: Hints & Tips, Acorn User, Redwood Publishing, 68 Long Acre, London WC2E 9JH.

VDU in command

MORE and more programs are making use of VDU commands to replace those Basic keywords that are concerned with printing on the screen. Consider the following line from a program:

```
10 VDU12,31,10,10,72,69,76,76,79
```

This line will clear the screen, move to the position 10,10 and print the word 'HELLO' on the screen. However, it is not clear what the line does, unless one is familiar with all the ASCII codes and the VDU codes. It can be made more readable by using a print statement:

```
10 VDU12,31,10,10:PRINT"HELLO"
```

We could go a stage further and remove the VDU command altogether:

```
10 CLS:PRINTTAB(10,10)"HELLO"
```

Now the line is far simpler to understand. There must be an advantage to using the former method – memory perhaps. The first line of code took 34 bytes of memory, the second 28 bytes and the third only 24. Point taken?

VDU commands have their rightful place in programming, but use them with care and ensure they do not hinder understanding of the program.

Campaign for real numbers

SEVERAL readers have had difficulty with money programs that will work out VAT and check totals etc. The problem was first highlighted in this column in December 1983. It is a problem that can affect many program applications, and many new readers have joined *Acorn User* since last year, so I make no apologies for repeating the point.

How do the BBC and the Electron handle numbers? Well, they differentiate between two types of numbers: real, which can contain a fractional part, and integers, which are whole numbers. Integer variables are distinguished by having a % sign as the last character of the variable name: eg, number% and count%. They can store only numbers between −2,147,483,648 and 2,147,483,647. Integer variables are stored with complete accuracy and are operated on more speedily by the computer.

There are also 27 integer variables which the *User Guide* calls the Resident Integer Variables. They are A% to Z% and @%, and have a permanently allocated space in memory. As a result, their values are not lost when RUN or NEW are entered, or even BREAK is pressed. This enables values to be carried by these variables from one program to another. (Have you ever wondered how the WELCOME tape remembers whether your cassette has motor control from one program to another? It uses the resident integer variable M% to inform each individual program.) The @% variable has a special function, as we'll see.

Real numbers with a value between 2×10^{38} and 2×10^{-39} can be stored by the computer and can include negative numbers. The disadvantage with real numbers is that they can be stored only to nine-figure accuracy. (Basic 2, the version of Basic present on the Electron and new BBCs, will work to a 10-figure accuracy.)

The numbers must be converted to binary before being stored and this leads to many problems. Some numbers cannot be represented with complete accuracy this way. This is a similar problem to the recurring decimal found when 10 is divided by 3 or when trying to calculate exactly the value for the ratio of diameter to circumference of a circle. This ratio, called *pi*, is a never-ending decimal, and can never be represented with total accuracy.

To illustrate the difficulty of storing and retrieving numbers accurately look at listings 7 to 9. Listing 7 works as one would expect, but with only a slight change in numbers listing 8 does not give the correct result. It is interesting to print out the values for A, B and C and see what happens to them. Listing 9 will do this, To add to the confusion, we find that it prints out the correct values even though the program has given the wrong result!

Before you throw your computer away and rush out to buy another make I should point out that this program will not function correctly on the majority of other micros. The reason is that the computer has a routine built into the PRINT statement to check for the correct errors in number storage and retrieval. Unfortunately there are no such routines in the equals, greater than or less than operators and these give rise to problems, particularly when trying to perform money calculations.

There are two possible ways round the problem. The first is to multiply the real numbers by 100 and work in integer arithmetic. To display the results divide them by 100. For the sake of simplicity we are assuming that halfpence will be ignored. Listing 10 gives an illustration of this method. Using the print format variable (@%), the figures are printed out to two decimal places. By using integer arithmetic it is possible to store values up to 2 million pounds accurate to the nearest penny.

This method as it stands is not foolproof, as real numbers still have to be stored in memory. Try adding £29.49 and £10. To get around this, instead of multiplying and dividing by 100, change the program to multiply and divide by 1000. This means that the real number is converted with a ten-fold greater accuracy. (It now also enables halfpence to be entered.)

The other cure is to use a relative test rather than trying to equate two totals exactly. As any value less than £0.005 has no significance in our monetary system, we can utilise this to provide a better test for totals agreeing: Listing 11 shows how this can be done. The ABS statement ensures that the test will work if either total is larger.

Disc detector

ON A BBC machine fitted with disc interface it is often useful to detect the presence of a disc drive during a program, say to give the option to save data on either disc or cassette. A way to do this is to assume that if a disc drive is fitted then the program will have been loaded from disc. If this is the case then *OPT2,1 can be used to differentiate between disc and cassette. It will give an error message with a disc filing system, but not with the cassette filing system. It gives error number 203 (bad option) with disc.

This could be detected to differentiate between tape or disc, or the line number at which the error occurred can be detected as in listing 12. To check that listing 12 will work (on a disc machine of course) type RUN, then press BREAK, which will rerun the program but with tape option selected.

The computer will remember the last error line until either a new error occurs or BREAK is pressed. This is why the BREAK key has been used in this program.

Printer check

SOME programs that make use of a printer tend to hang up if no printer is present. There's no easy way of getting out of such a situation at the time. It is better to include a routine in these programs that checks to see if a printer is connected first. The ADVAL statement can be used to check whether a printer is connected and switched on, and a little-known use for the statement is to check the state of the various buffers. ADVAL(−4) will check the state of the print buffer.

Listing 13 shows the technique. Two spaces (code 32) are sent to the printer

only (two are necessary as the first one disappears somewhere down the line and does not stay in the buffer), and then the buffer is tested to see whether it is empty. If it is, a value of 63 will be returned. If the space is held in the buffer then the value returned will be 62. This idea is easy to incorporate into programs.

Ribbon rewind

HERE is a tip that will double the life of some printer ribbons. Dot matrix printers use a continuous ribbon in a cartridge, which can often be prised open to get at the concertina'd ribbon. When the printing is becoming faint and a new ribbon is needed, try opening the cartridge and removing the ribbon. Replace the ribbon upside down and rewind the ribbon back into the cartridge. This trick works because many printers do not print in the middle of the ribbon, but near one edge, so reversing the ribbon allows the other edge to be used. Some cartridges are better designed, however, and the ribbon already has a half twist in it so that the top and bottom of the ribbon are both used – in which case this tip is no use!

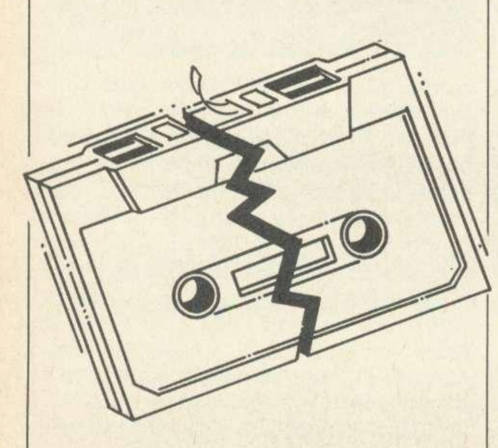
Cassettes under scrutiny

THE weakest link in the BBC or Electron computer system is the tape recorder. Cassette players were designed for audio work as a low-cost, miniature alternative to the reel-to-reel tape recorder. When used with a computer, the cassette is pushed to the limit of its performance. It is no use dusting off an old cassette that has long since seen better days, and wondering why no programs load from it. The cassette needs to be in tip-top condition.

However, problems can occur, even with new cassette recorders. Mr Brazier of Kent sent in a tape that would not load a program he had saved. On listening to the tape a rhythmic beat could be heard on top of the normal tone.

This, I suspect is caused by one of two things. First, leaving the cassette's Play button down after the program has loaded. On a cassette that has motor control, this is all to easy to do – one simply forgets to switch off the cassette. Inside the mechanism is a rubber wheel which presses hard against the driving spindle when the cassette is in the Play or Record positions, and this assembly regulates the speed of the tape. If the rubber wheel is left in contact with the spindle for some time while the motor control is off, then a depression will form in the wheel that will usually spring out again in the course of time (but not always!). If the cassette is used in this condition, the sound will be distorted and load and save errors will be produced.

The second cause could be a small piece of dirt stuck to either the rubber wheel or the spindle, or even damage to one or the other. Similarly the tape speed will be uneven and cause tape faults.



Weakest link in the system

Speedy circles

MR GLOVER of London has sent in two methods for speeding up circles. The first (listing 14) uses the trigonometric identities:

COS(n+1)x = COSnx * COSx – SINnx * SINx
SIN(n+1)x = SINnx * COSx – COSnx * SINx

The calculation of COS( ) and SIN( ) is done only once and the loop involves only multiplication, addition and subtraction, so the circle is drawn faster.

Listing 15 is even faster and would be very effective for a program that needed to draw many circles. The appropriate sine and cosine values are read into an array, which is then used in the circle procedure. This routine is slow, however, if the time taken to put the values into the array is also taken into account.

The on/off dilemma

MR SMITH from Surrey writes: 'I am in the habit of leaving my BBC micro switched on for up to 10 hours at a time. This is mainly for convenience of use, but also because I believe it to be bad practice to switch the machine on and off too often – I understand that the stress caused by heat/cooling is one of the main reasons for early failure of electronic components.

'My question is: would it make sense to leave the machine (only) switched on continuously, even overnight? Does an unattended BBC present any kind of fire risk?'

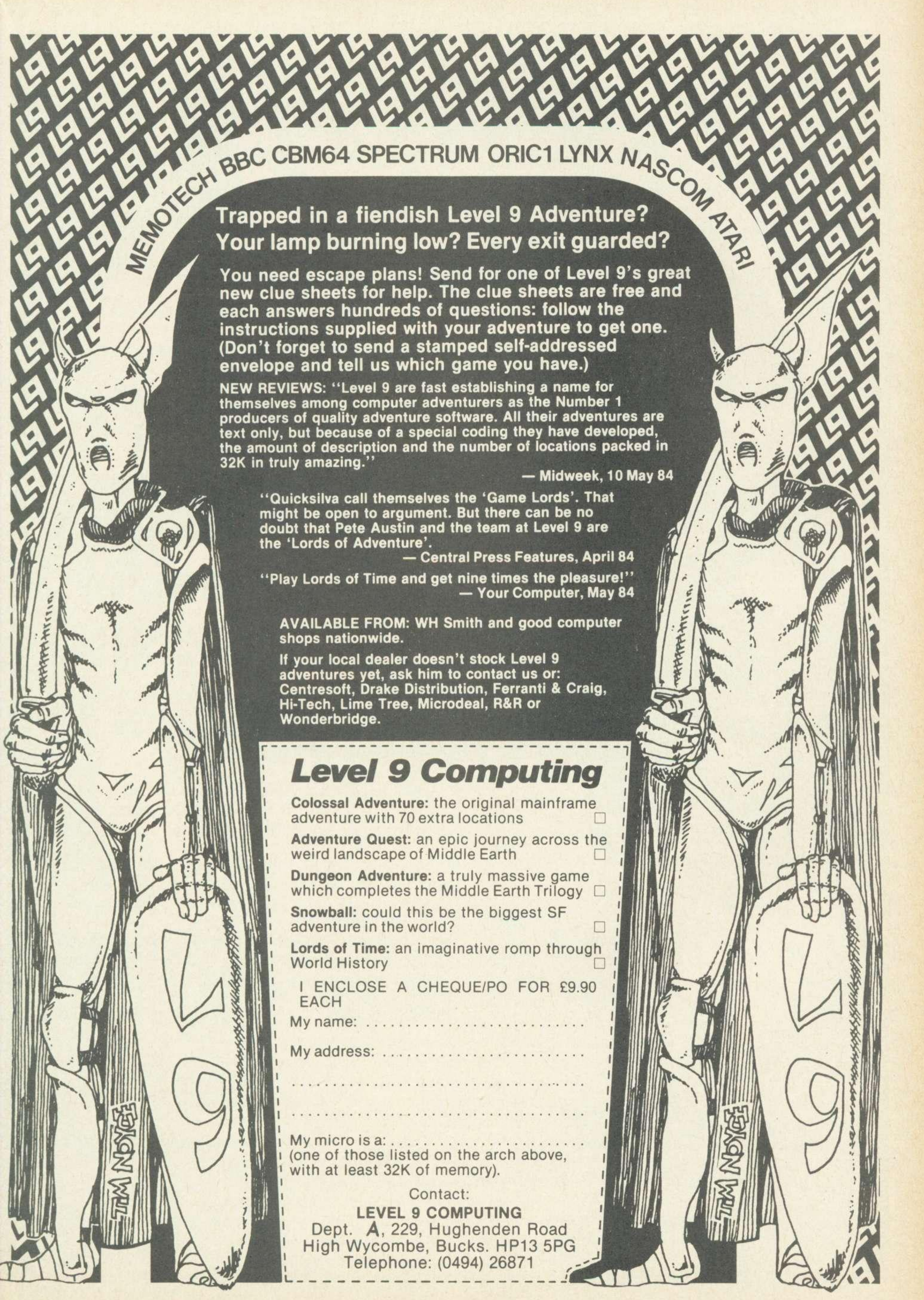
'Component overheating is a sure way to reduce life-span'

The usual way the life of an electronic assembly is calculated is not in terms of the times it is switched on and off, but in terms of the number of hours of use, and how close each component is to its maximum operating conditions in use. Component overheating is a sure way to reduce life-span. If the components never get too hot then there will be less chance of premature failure, or stresses caused by heating and cooling, so my advice to Mr Smith is switch off the computer if he is not going to use it for some time.

Modern components are designed to withstand the stresses caused by heating and cooling within their normal working temperature range, and damage occurs only when the temperatures rise above this range. To leave the computer on continuously will reduce the life of the computer rather than extend it.

There is always a possibility of fire risk with electrical equipment, and unless the equipment is designed for continuous use it is far better to switch off when not in use, although I have never heard of a BBC bursting into flames.

Mr Smith's computer has one of the old linear power supplies which gets very hot, and he also asks what the signs are of the power supply being overloaded as more and more ROMs and other devices are added that draw on the power from the power supply. The answer is unpredictable behaviour on the part of the computer, or a total failure to work. These could be symptoms of many specific faults, but an overloaded power supply will cause errors to occur in many parts of the computer. If the linear power supply (these are usually black as opposed to the gold colouring of the switched-mode power supplies) gets very hot then it would be wise to have it replaced before it fails and possibly damages the rest of the computer. A local Acorn service agent will be able to do this.


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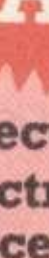
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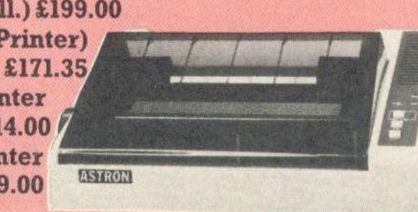


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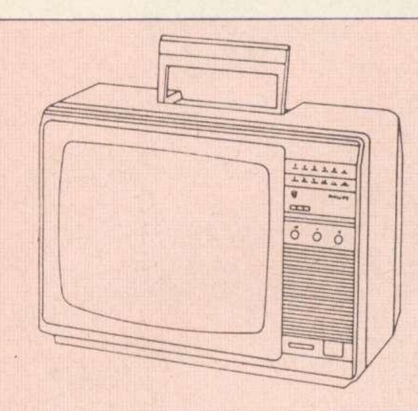
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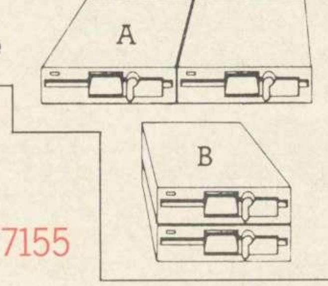
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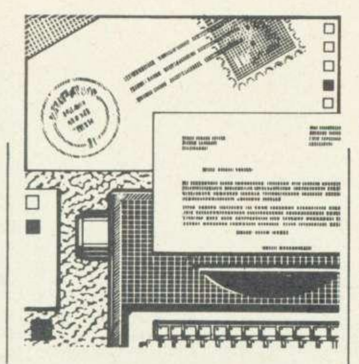
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How I became an expert in piracy

Sir, Concerning your recent letters on software piracy, I felt compelled to write to you. I am a 15-year-old schoolboy who has a BBC and disc drive. To begin with, I had no professionally produced software at all. Then a friend lent me a tape containing Acornsoft's *Defender* (now *Planetoid*, of course), *Snapper*, *Monsters*, and Bug-Byte's *Space Pirates*. I enjoyed playing these, but then had to give the tape back. I had no knowledge of tape-copying so I had to do without them.

I thought so much of *Defender* that I ordered it from Acornsoft and was very happy with it. I then learnt the basics of tape-copying, which, believe it or not, I heard a computer games magazine reviewer mention at a computer show. He said he pirated any game he reviewed! I bought a few more games every so often, and then received a disc drive, when I found none of the games would work on disc. I picked up the tape-to-disc techniques and now I am fairly proficient in tape-disc transfer. Funnily enough, the clever tape protection I meet doesn't stop me copying the tape, it merely makes it difficult to get onto disc!

If you think about it, as long as there are people who want software, the industry will survive. After all, if there are no new games to copy, everyone, pirates included, will want to *buy* some new games, and so a company would spring up to satisfy the demand.

As long as companies push out second-rate software I will not hesitate to copy programs. Also, it is a fascinating pastime to break protection (well, I think so).

Anyway, I have spent £150 on games in all. I have been satisfied with all Acornsoft (six tapes, one disc) and Program Power (two tapes) I have bought, but that is all. I have around 200 plus games programs now, of which very few are any good at all. I probably would have spent even more money on poor games if I had not learnt about tape-copying. I have spent £70 on ROMs and have been pleased with those, although I have many pirated ROMs.

Anon

It's quite a joke in Oz

Sir, It is quite amusing – no, no I'll have to say hilarious – to read the complaint letters from your English resident readers on the subject of software prices and piracy. Oh yes, we really are laughing, I can tell you!

No seriously, it is quite a joke here in Oz (that's short for Australia), you guys always complaining about paying £8 or £9 for the average games software; and *Wordwise* or View ROMs for mere pittances of £32.

I just thought I'd clear the air down there in Pommie Land by telling ya's all that up here we pay about £25 for things like Pacman, space invaders and sliding puzzles (all Acornsoft, of course), and about £70 for excellent (but not worth it) products like *View*. Even the computer itself costs about £800 for a model A, while Epson FX80 printers (at least, I think they're FX80s!) cost about £600, and for some reason the average daisy-wheel printer costs about £650.

So much for 6502 second processors, modems and Bitstik graphics programs! Often the only way to get any programs at all is by resorting to that bugbear of all software manufacturers, piracy.

So if you guys think you've got problems, ha, ha, ha. Say, how about some of you English software firms like Program Power, or Superior Software, or anybody – *please* – trying to break this damnable monopoly over here and bring in some rationality to the not insubstantial Australian computer market. At the very least, you're bound to make a fortune!

Tim Parsons
Hobart, Tasmania

Protection: the big challenge

Sir, I am a pirate, and have long been one. I regard any new development in protection as an intellectual challenge, and I haven't failed yet.

With regard to 'self-destruct' devices to prevent copying of EPROMs, how then will it know when to self-destruct if it cannot distinguish between the CPU accessing it to execute the program within it, and accessing it to copy it?

Having said all this, I do make some defence. I don't sell the software I pirate, I merely copy it for my own and my friends' use – and most of it doesn't get used. Most of the games sold are not worth the disc space required to keep them. The prices charged, especially by some companies, for sloppily coded, badly packaged rubbish are extortionate in the extreme, and, after buying three games since receiving my BBC, I vowed never again to buy a piece of software.

To close, I would like to say to all software houses: get your act together, bring out some decent software for a reasonable price, instead of wasting money on developing ineffective 'anti-copying' devices, and I might just change my mind.

Anon
Gwynedd

For a tidier key strip

Sir, I should like to offer a small improvement to the function key strip program written by Andrew Britton (July issue, yellow page I). I have made a slight change to line 330 so that the text is centred within the boxes.

The additions are as follows:

```
330 FORN%=1TO10:READ
  A$:1=INT((n–LEN(A$))/2)
335 PRINT"!";SPC(1);
  A$;SPC(n−(LEN(A$)+1));:
  NEXT:PRINT"!"
```

INSERT MODE	DEFAULT RULER
HIGHLIGHT 1	HIGHLIGHT 2
BEGINNING OF LINE	END OF LINE

Detail of the key strip

I hope users will make what is already an excellent and useful little program a little more pleasing.

K Stephenson
Cumbria

Copying ROM

Sir, In reply to G Dubber (June issue), the introduction of sideways RAM boards may be seen as a threat by manufacturers of ROMed software, but they would be foolish to follow his advice.

I bought my sideways RAM as an extremely versatile alternative to a normal sideways ROM board and I would be less than delighted if my investment were rendered useless for future ROMs. Since most ROMed programs tend to be duplicated by other software houses (lots of wordprocessors and databases to choose from) I will buy those that allow me to use my program as I see fit – after all it *is* my program unless I try to sell it illegally.

P Faskett
Liverpool

Offensive weapon

Sir, Have you noticed the unsubtle advertising for educational software on the BBC micro? At the top of one catalogue there is a *gun*.

Is this a symbol that should be associated with teaching? Children are readily influenced by what they see on computers and there are enough zap and kill games already. There is no need to bring weapons into the education environment.

M Richards
(Teacher)
Sussex

The source

Sir, I have solved 90 per cent of the software piracy problem on 8-bit based micros. Ninety per cent of programs do not use overlays, and therefore exist completely within the 64k addressable by the 8-bit microprocessor. Now each bit (there are 64x1024x8 bits available) can be set either to 0 or 1. There are therefore 2 to the power 64x1024x8 possible


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plus VAT and P + P
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plus VAT and P + P
We ran the advertisement opposite to move some stock left from a cancelled order. And move them it certainly did. We're still selling around 30 boxes a day, that's over 30,000 disks a month. So we bought some more, and are going to continue selling at the same price.
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XLtron

combinations, and these must include every program that can ever be written for any 8-bit microprocessor.

My micro is currently acting as a program generator, listing all the possible combinations, and therefore I will soon possess the copyright on all programs not yet written. I am following standard microcomputer business practice in that I am announcing these programs slightly before they are finished, and most of them will eventually prove to be useless rubbish, nevertheless they are *mine, all mine*.

The solution to the piracy problem is that I hereby give my permission for anybody to copy any of my programs so produced.

G Swain
Berks

Secrets of the floating point

Sir, I have a number of large programs half-written for my BBC model B but they must all be converted to machine-code as they are far too slow in Basic, however well written. The problem is that they all require floating-point mathematical functions that are in the Basic ROM.

I wrote to Acorn asking for the addresses of these routines and how to use them but they said that there was no data sheet available on either Basic ROM. Commodore supplied the equivalent information on its Vic-20 for Nick Hampshire's *Vic Revealed*, as did Sinclair for Toni Baker's *Mastering Machine-Code on Your ZX81 or ZX80* so I see no reason for Acorn to withhold this for the BBC micro.

I could write routines for multiplication and division of floating-point numbers but these would be useless without the trig and log routines.

I am therefore writing to you, asking if either you or any of your readers can help both myself and, I am sure, many other people, with this problem.

Neil Howard
Herts

Breaking point

Sir, In the July *Acorn User* a reference is made to using CALL !–4 as a software substitute for pushing the BREAK key. This should be used with care, as it can have unwanted side-effects, since the BREAK key also provides hardware resets to certain chips in the Beeb besides the 6502 microprocessor. Often there will be no discernible difference, but it is advisable to disable the NMI system by setting &D00 to &40 (RTI) immediately before making this call to prevent the disc or Econet from crashing the system.

Also, users with Econet and the new DNFS ROM will find that Econet disappears completely if you type CALL!–4. This is because the ROM checks that the Econet 68B54 exists in a reset state when it initialises, and if it doesn't then it switches out the Econet half of the ROM! This is so that the ROM can be used on disc-only machines.

Both these precautions are contained in the following code, which I have found to work satisfactorily without problems:

```
.break LDA#&40:STA&D00:
LDA#&C0:STA&FEA0:
JMP(&FFFC)
```

Storing &C0 in &FEA0 initialises the Econet so that DNFS still thinks it's there!

On a completely different tack, the sound effects on Yellow Pages XVI of the July issue reminded me of a very simple yet effective program that I use when teaching about nested FOR . . . NEXT loops (listing 1). It speaks for itself, lasting about 48 seconds. It is worth pointing out that the step sizes should both be prime numbers for maximum variety.

```
10 REM Freak Out by R. Newman
20 FOR X=200 TO 800 STEP 23
30 FOR Y=200 TO 800 STEP 17
40 SOUND1,-15,X*Y,1
50 NEXT Y,X
```

Listing 1. Robin Newman's noisy demonstration of nested loops

Robin Newman
Peterborough

Better chess

Sir, In the March 1983 *Acorn User* there was a review of three different chess programs by Computer Concepts, Program Power and Bug-Byte. Computer Concept's *Chess* was the earlier version 2.32 C1 but there is a new version 2.32/1 E/A, which provides a few more facilities.

I decided to put this new program through some of the tests that the other programs were put through. The results are recorded above:

Mate in two moves (three-ply)	
New version —correct	1 min 41 secs
Old version —correct	22 secs
Mate in two moves (three-ply)	
New version —correct	59 secs
Old version —incorrect	18 secs

Mate in three moves (five-ply)	
New version —correct	27 mins 38 secs
Old version	test not given
Program Power *Chess* —correct	49 mins
Acornsoft *Chess* —correct	35 mins
White Knight —correct	15 secs

The new version is much improved, allowing a Blitz game to be played and OS commands to be entered during the program. I have been very satisfied with this program and I would recommend it.

Duncan Miles
Kent

Computers in adult literacy

Sir, Jonathan Read's article on computer applications in adult literacy (*Acorn User*, June) not only reflects how far behind the primary sector we are in terms of software experience, it also highlights the lack of fluent dialogue between Adult Basic Education tutors and software designers.

A root cause of this impoverished state of affairs is the patchy nature of computer-related inservice training funding for ABE, but then it could be argued that there is no cohesive demand from the scattered full (but mainly part-time) ranks of professional (mainly women) tutors plus the hidden army of volunteers. Furthermore, it does not make for good economics in terms of college survival to cater for the Have Nots.

Jonathan Read might benefit from being made aware of the qualitative non-didactic methodology of the many ABE tutors, whose primary resource for materials acquisition lies in the students' own vocabulary rather than books *per se*. Some excellent examples of print-based materials along these lines can be found at the Gaddum Centre, Deansgate, Manchester.

His statement 'The students waste a lot of time trying to hide their ignorance from the tutor and themselves' and also that it is 'no help to the students to be given work that they already know since they are bound to get it right' suggests that he may also benefit from an appreciation of ABE training methods in student/tutor relationships and confidence-building techniques.

To state that the computer has more of the human qualities of patience than an ABE tutor and more flexibility may be a little misleading and may not inspire ABE tutors to warm to their use. It may be more helpful for tutors to find out how the computer can be a powerful *optional* resource rather than a teaching machine (as implied by Jonathan Read), that may do many of them out of the few part-time hours they are grimly hanging on to.

There is always a place for specific drill and practice programs like flashcards, in spite of comments like 'paper flashcard are 10 a penny. What use a computer?' However, some ABE tutors might like to see a new generation of programs which allow greater creative control of the text by the students, while others might be interested in group problem-solving activities that are life skills related. Whatever the case, there is much that can be learned from the primary sector, whose software I am familiar with, provided an adult context is adopted.

Eileen Fawcett
Secretary, Computers in Adult Basic Education
15 Berbice Road
Liverpool L18 0HU

ASK a silly question, pass a fair comment, stage an angry protest – we don't mind what you write to us about (or about us!). Keep 'em short, keep 'em sweet, but keep 'em coming! The address is: Letters, Acorn User, Redwood Publishing, 68 Long Acre, London WC2E 9JH.

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Activity board adjustments

Sir, I have discovered a few inconsistencies between listing 1 and the text in my article on the activity board project (August issue).

The final paragraph (page 113) should read as follows:

To change the sentences to fit a new situation, change the data lines 710 to 790. Type your new title on line 710, followed by your eight new sentences. One important point – because of the double-height letters, the sentence must not be longer than one line. If you want single-height letters type line 510 as follows:

```
510 PRINT B$(J)
```

and line 580 as follows:

```
580 PRINT D$(K)
```

and leave out line 590.

In addition, the program analysis is one line behind the listing from line 130 to 520 and two lines behind from line 530 to the end.

Susan Kingsbury
Norfolk

Brother's buffer a puff?

Sir, I enjoyed the On-line Typewriter review in the July issue but I was amused to see that Barry Pickles has also been taken in by the claims of the advertisers of the Brother EP44 that is 3.5k text buffer is sufficient for 'about three pages of A4'. Of course it is not. It gives only about one paragraph overleaf from *one* page of A4 single-spaced text, and it is highly misleading of Brother to suggest otherwise. One line of average text on A4 takes about 60 characters, even leaving a generous left and right margin, and 60 lines of text falls well within the length of an A4 page.

Apart from this major discrepancy, which should be brought to the attention of the Advertising Standards people, I find the machine lives up well to the claims and reviews. Certainly the print quality is a great improvement on that of the EP22 and 20. But then look at the extra cost!

J Watson
Herts

Kitty untangles some of the jargon for two confused readers



Q I must say I find my new BBC B plus disc drive a bit bewildering. It is all very well to be told to print * $ " : , . – /. But what I want to know is why these extraordinary symbols are chosen and to do what exactly – will I ever get to know? How do you write a program if you don't know what CHR$ is actually doing?

Charles Berridge
Sussex

A Yes, the symbols used in many Basic programs can indeed be very confusing and seem to have been an odd choice. The history behind them is simply that the first real computers were American and they used the standard American qwerty typewriter keyboards: they have $ instead of £, for example. Really, it's all quite arbitrary – you just have to accept and memorise each symbol and what it does.

The various unfamiliar symbols just act as a code to the computer. The asterisk (*) usually signifies multiplication but when used in front of a word means that that word is not a Basic command, but an operating system command. So any word with '*' in front of it is dealt with by the operating system chip instead of the Basic chip. The slash (/), means divide.

There are two kinds of variables in Basic: number and string. Number variables contain only numbers, whereas string variables contain letters, symbols or whole words. The Beeb stores the two kinds in different places and so needs to be able to find them again easily – this is where the $ sign comes in. The $ is used to define a variable that is to hold a series of characters rather than a number, eg, A$ = "Charles".

Quotes are used to enclose the characters so that they appear on the screen rather than being acted on inside the Beeb. The full stop is used to denote a decimal point in a number, while the comma merely separates items in a list. A semi-colon is used in several ways: in a PRINT statement, for example, it ensures that text is printed on a single line, thus avoiding a carriage return.

Finally, the colon is used to separate several commands in a single line, thus telling the computer where its end and start is. Look through any listings in this issue and these definitions should become much clearer.

CHR$ is the computer shorthand for 'the character with the code number . . .' So PRINT CHR$(69) means: print on the screen the character with the code number 69 – in this case a capital E. You could do the same with PRINT"E", so why bother? Well, some characters don't have a key on the keyboard – graphics characters, for instance – and here the only way of referring to them is by CHR$ and their code number (a list of code numbers is given in the BBC *User Guide*).

Q I have great difficulty in understanding what sideways ROMs and RAMs, second processors and ROM extension boards are and how they affect the workings of the 'standard' system.

Could you point me towards a book or article that might clear up some of my confusion. I have only recently started reading *Acorn User* – perhaps a back number is available which does this.

Andrew Sims
Glasgow

A Perhaps the biggest barrier in the path of anyone breaking into the world of computing is the jargon. The computer world is full of it; however, as in most specialities, the terms are quite easily understood. RAM and ROM are mnemonic terms that denote different types of memory on a computer. ROM (Read Only Memory) is a permanent memory – its contents are always available when the computer is on and cannot be changed from the keyboard; RAM (Random Access Memory) is more volatile and when the computer is turned off its contents are gone for ever – unless you've stored them on disc or tape first. The programs you enter are placed in RAM.

The BBC micro can have several chunks of RAM or ROM physically sitting side by side on the circuit board, but with only one in use at any one time (except the operating system – that is permanently on). By using certain commands (for example, '*WORD' to get you into the *View* word-processing system) a particular ROM can be switched in or out of circuit. This technique is known as paging, and the ROM/RAM used to perform it is known as sideways ROM or RAM.

ROM expansion boards are commercial devices that can be plugged into the Beeb to take advantage of the sideways ROM capabilities of the micro. On a standard BBC micro up to four sideways ROMs may be installed at once; with the addition of a ROM board this may be extended to 16.

The term second processor can be taken literally, for that is what it is – an extra microprocessor that is connected to the Beeb. However, a second processor can transform your Beeb into a sophisticated graphics design package (with the 6502 plus Bitstik installed) or a comprehensive business system (Z80 plus software).

ROM expansion boards do not encroach upon the operation of the standard system. Some ROMs can have a disconcerting effect, but only if you have two (or more) ROMs that use the same keywords – then some very annoying things can happen. The solution is to take out the ROM that you do not want to use. Much of the currently available commercial software, sadly, will not run on the 6502 second processor. So the ultimate solution if your software is not working is to switch the second processor off.

See page 94 to check what has appeared in past issues.



'Set 'em up' Joe Telford keeps the children busy during the school holidays with half a dozen problems to solve by programming

PROBLEMS? NO PROBLEM!

THIS edition of 'Jottings', again under the Education banner, is unashamedly aimed at the younger User. Mums and Dads should therefore hand over the magazine to their offspring, or even better, settle down with said offspring to do some simple programming based around problem-solving.

But before we solve some problems, we should know what a problem is. Most of us adults picked up a rough idea at school of how to do problems. Because of this we often think all problems are mathematical. Actually a problem is better thought of as something that prevents us doing as we want. This means that we all have problems at different levels:

- John doesn't want to go to school. This poses a problem for John, and possibly for other people.
- Jean cannot decide whether to buy an LP or a blouse. This poses a problem for Jean.
- The school secretary needs to keep track of every pupil in the school each minute of the day. Another problem.
- A bank clerk must change English money into foreign currency at the correct rate. Another problem.

Problems tend to be personal or impersonal. John's problem is personal, as is Jean's, while most school secretaries and bank clerks have the problems outlined above. We can say that these problems are impersonal. Personal problems are usually best dealt with by people, because these problems often need sympathy, understanding, intuition or other human attributes. Computers would make a pretty poor show of handling such problems.

How does Joe solve the problems in this feature?
For six of the best turn to yellow pages xi to xiii.

If we consider problems that are impersonal, we might expect to find such problems as:

1. How can a supermarket improve the service it gives?
2. How can I use a computer to clock-on people in a firm?
3. Which is the best camera?
4. Which is the fastest 1000 cc four-stroke motorcycle?

Here again the problems can be separated into two types. Problems 1 and 3 are general, while problems 2 and 4 are more specific. It is usually easier to obtain a computer-based answer to specific problems than to general problems.

Often, though, problems may have several answers. The correct answer is the one that works in real life. Sometimes many of the answers will work, and sometimes only one. If we consider the type of problems producing one correct answer, these are almost always mathematical. For example:

If six men dig a trench in 12 days how long would it take 12 men?



However, most problems have many different answers, depending on the factors involved. Generally speaking, a problem is made more specific as all the factors affecting it are made clear. For example, in that last problem the mathematical answer might logically be thought to be 6 days, using the principle of doubling the workforce to half the time. However in real life such a problem is never as simple. The factors which might affect the answer to the problem include:

- What is the maximum workforce available?
- How many men can work on the trench together?
- Must anything be done during the dig? Eg, disconnecting gas/electricity?
- If someone falls ill can he be replaced?

In this article we are mainly interested in finding a solution to each problem. Sometimes the 'correct' answer is obvious, other times there is no 'correct' answer. Provided we try to solve the problem logically this does not matter. Adults should understand that the thinking around a problem is as important as the answer itself.

The first and most important stage of solving problems is to know what the problem is – and we should always write it down. Let's take a typical problem:

How can we easily calculate the amount of foreign money we can buy with a quantity of English money?

The problem is reasonably well specified, but we might not know where to begin. If it's difficult to begin a problem then we should *alter* the problem to be very simple indeed. This helps us to put our thoughts into order. A simpler version of the problem might be:

How much French money can I buy with 15 pounds Sterling?

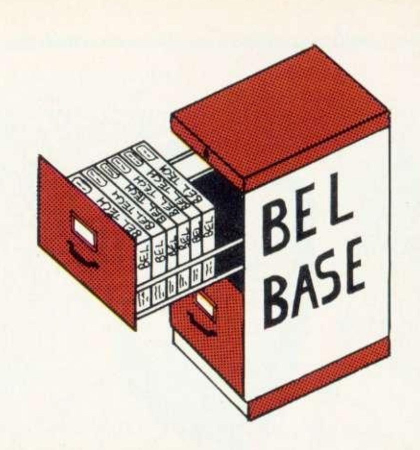
An easier version still might be:

How many francs can I get for 1 pound?

Now we must think about what extra information we need to solve this simple problem. Obviously we need to know how many francs can be bought for a pound. This is called the exchange rate

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* CALCULATION Options. Calculate a Field from the value of others, enter Functions etc. – and change them!
* AMEND the Name, Type, Default Value of any Field
* SEARCH and REPLACE on all Fields, all Records
* SELECTIVE and GLOBAL EDITING of Records
* INSERT Records, DELETE a Field or Record
* BROWSE Option
* FIND (Search on any Field) Print Screen if required
* DISPLAY or PRINT Reports (max. 38/137 characters across)
* PRINT all Records (2 Fields) or all Data
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* SORT on any Field (Ascending/Descending) whether Printed or not
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and if we go into our local bank we'll find a list of present-day exchange rates. Francs might be listed as 11.50 francs per pound. The simplest problem can now be solved:

I can get 11.50 francs for 1 pound

The next level of the problem is more difficult. To find out how many francs in 15 pounds, we must multiply 11.50 by 15. We have found a large part of the final solution now because for any currency we can say:

Foreign currency = number of pounds * exchange rate

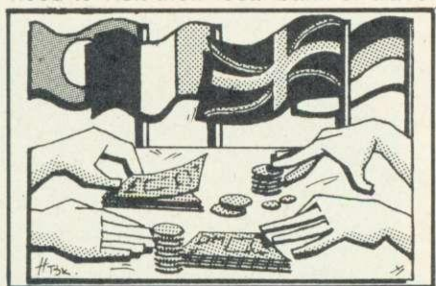
or

foreign = pds * rate

To handle all the different types of currency we will need a list of all the exchange rates for each country involved. A good way along the path to an answer might be to jot down the sort of sums we might have to get involved in. At this stage we use a cross between English and Basic to put our thoughts onto paper. Eventually we will use full Basic:

```
IF country is France THEN foreign =
   pds * 11.50 francs
IF country is Austria THEN foreign =
   pds * 36 schillings
IF country is Belgium THEN
   foreign = pds * 78.5 francs
IF country is Canada THEN foreign =
   pds * 2.25 dollars
IF country is Denmark THEN
   foreign = pds * 14.5 kroner
etc
```

The list of exchange rates above is deliberately incorrect, so Users will need to visit their local bank or travel



agent to get an up-to-date list. (Take a notebook and pencil to copy the list from the currency board.) Equipped with this information, we can consider the stages of writing the program.

We have to do three things to solve this problem. Our first ideas might be:

1. Enter the English cash.
   The exchange rate.
   The country involved.
   The name of that country's currency.
2. Perform the correct calculation, depending on the country involved (as shown above).
3. Print out the answer.

In banking the exchange rate, the currency name, and the country name would be always available to staff, and the real input would be the name of the country and the quantity of English cash. We need the country name so that the correct exchange rate can be found, and the quantity of cash to perform the multiplication necessary.

A useful approach when coding these problems is to make each major part of the solution a procedure in its own right. Then if a bug occurs in one part of the program it can be tracked down by considering each section in turn. These stages can then be swiftly hung together using a main program body like:

```
 50 REPEAT
 60   PROCinput
 70   PROCprocess
 80   PROCdisplay
 90   PROCspace
100 UNTIL FALSE
```

The three main procedures can be used over and over (until ESCAPE is pressed) and the PROCspace procedure allows each answer to be read before progressing to the next input. A large number of simple problems can be handled in this format. Program 1 shows one solution to the Bureau de change problem. The processing section requires the addition of further countries, currencies and exchange rates, but this is a useful way to spend an afternoon collecting data. Users should also consider writing their own versions, or improving on program 1. Alternate modes, coloured printout and making tabularised output might all be considered.

The second problem to solve derives from the well-known riddle: 'When is a Beeb not a Beeb? . . . When it's a POST'. A POST – Point Of Sale Terminal – can be regarded as a special cash register. In its simplest form it can do five tasks:

1. Input amounts of money.
2. Total them.
3. Input the amount paid.
4. Calculate change needed.
5. Display the change to be given.

The problem is to simulate a POST with the BBC micro. The above POST spec. gives us our outline for solving the problem. Let's examine the task in detail. We can start by thinking of the main body of the computer program. We can produce this directly from the problem spec. The solution starts by taking the general problem and breaking it down:

```
 50 REPEAT
 60   PROCinputandadd
 70   PROCtotal
 80   PROCinputcash
 90   PROCcalculatechange
100   PROCshowchange
110   PROCspace
120 UNTIL FALSE
```

Notice that each of the procedures roughly matches the stages of the problem specification. The REPEAT . . . UNTIL loop and PROCspace are simply trimmings that will make use of the program easier.

The next step is to produce 'English-Basic' pseudocode solutions to each of the procedures. The 'inputandadd' procedure might be summarised as follows:

```
Make the total 0
REPEAT
  INPUT the cost of an item
  IF the cost is more than 0 add it onto
  the total
  UNTIL the cost is 0
END this section
```

Compare this with the coding of program 2 to see how each line relates to our summary in pseudocode.

The procedure to print the total of the items is easy to produce, as it will simply be a PRINT statement (lines 240 and 280).

In the section of the problem dealing with entering the cash paid a small problem might arise if someone offers an amount less than the actual total. This must be spotted. It is as covered in the following pseudocode:

```
REPEAT
  Input the cash paid
  UNTIL it covers the cost of items
```

This code transfers very easily into Basic:

```
REPEAT
  INPUT 'cash paid 'cash
UNTIL cash > = total
```

Readers will see the benefit of using long variable names. The last two subproblems, calculating the change and printing the amount returned, are covered simply by a subtraction:

change = cash − total

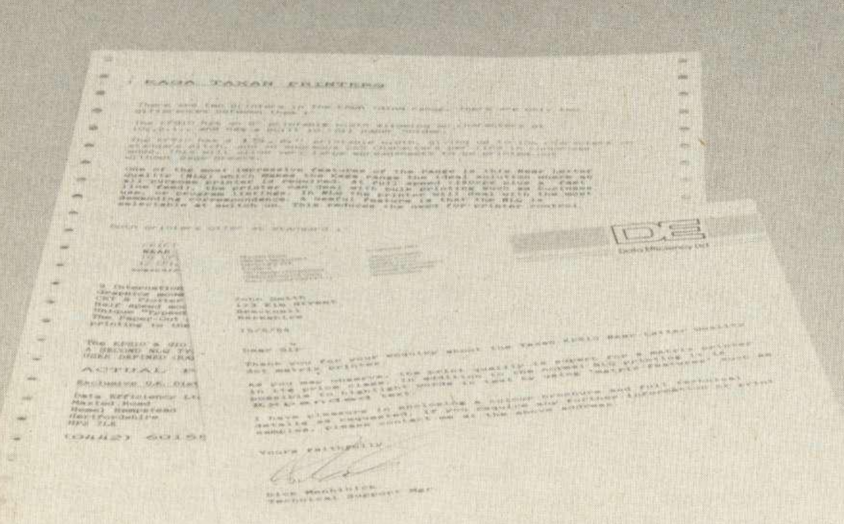
and then one or two PRINT commands. Program 2 shows the detail of these procedures.

To produce a pleasant layout, '–' characters are used in the printout sections of the program, and an additional aid to layout is the use of the @% variable in line 160 to produce two figures of decimals. The Z% variable is used to return the @% variable to its original state. This is important because in leaving one program to start another we should always reset the system variables that we have altered. This is actually done in line 440.

This problem should lead to many other ideas, possibly the most import-

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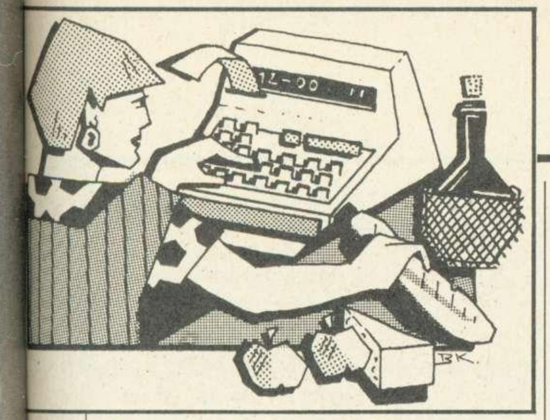
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ant being to visit a number of shops where POSTs exist and see what they do. This provides a jumping-off point for a number of investigations, eg:

- Can you make your BBCPOST open a cash drawer (or simulate this)?
- Can you perform a coin analysis of the change so that the BBCPOST prints out how many 1s, 2s, 5s, 10s, 20s, 50s, and 100s should be given in change?
- Can you introduce a code into the input section so that BBCPOST will tell you what the article is when that code is typed in?
- Can you further extend this idea so that BBCPOST tells you not only the code but the price too, and then adds that price onto the total?

The next problem is all a matter of timing. We regularly use the 12-hour clock, so that say 6 hours after 11am is 5pm. In this type of arithmetic:

11 + 6 = 5

If we want to demonstrate this using our BBC micro, then we need to perform three stages of problem-solving. You should be able to name the procedures in the main body of the program now:

```
REPEAT
PROCi....
PROCp......
PROCo.....
PROCspace
UNTIL FALSE
```

The difficulty in this program is not in entering the numbers. All that is required here are a number of INPUT statements to get the hours and minutes of the present time, followed by the hours and minutes that will pass before the new time. Nor is the difficulty centred around the printout of the final time – a simple PRINT line will take care of this. The difficulty lies in the calculation of the new time. Let's therefore consider this aspect in more detail.

If we add the present minute value to the number of minutes that have passed, then we will get a value that is either under one hour or under two hours (unless something silly like 120mins has been entered). So we have to take into account a possible 'hours carry'. When we add this hours carry to the present time in hours and then to the number of hours to pass, the answer will be greater than or less than 12. If the answer is less than 12 we simply use it as it stands. If the answer is more we must reduce it by subtracting 12 until the answer is less than 12. A special case occurs when the answer is exactly 12. This normally reduces to 0 but convention has it that the 12-hour clock starts at 12, and so any answer of 0 hours must be called 12 hours.

As we've said, when a problem looks difficult its best to break it down into manageable chunks. The last section should show us that the smaller chunks include:

1. Adding the minutes.
2. Checking for a minutes-hour carry.
3. Adding the hours plus carry if any.
4. Checking for the hours result over 12.
5. Reducing this by 12 until the result is in the range 0 to 11.
6. If the special result 0 occurs then add 12.

The clearer outline of the last section allows us to produce our English/Basic pseudocode solution:

```
new min time = present min time +
    passing min time
hours carry = new min time DIV 60
new min time = new min time
    MODulo 60
new hour = present hour + passing
    hours + hours carry
new hour = new hour MODulo 12
IF new hour = 0 THEN set new hour
    to 12
END this section
```

This process of moving from outline problem via progressively clearer stages to a solution is called refinement. Program 3 shows a completed solution in PROCprocess (lines 280 to 350). This is the Basic coding of our pseudocode. It is, however, possible to go a step further and produce an alternative process, defined in lines 390 to 430. This relies on understanding the first PROCprocess and reducing it to three essential expressions. The brackets contain all the contents of the original PROCprocess but in a condensed form. This further enhancement does not improve the solution, it simply makes it more concise, if less readable. This sort of condensation is normally applied to increase program execution speed, or reduce demands on memory space. Normally (say for exam purposes) the original PROCprocess would be quite satisfactory.

Here are further things you could do to develop the program:

Can you add lines to input the time of day as AM or PM and printout the final time with AM changed to PM and vice versa, if need be?

Can you convert this program to work as a 24-hour clock?

Can you produce a program that converts between 12 and 24 hours?

Can you produce a program that takes days of the week into consideration, in either the 24-hour clock or the 12-hour clock with AM or PM?

Can you produce a calendar for this month? Any month this year? Any month of any year?

The information picked up so far will prove useful in this next problem. The wages department of a large firm is to use a computer to work out the wages of each employee. The various subproblems have been listed and you have been presented with the subproblem of using the computer to calculate the number of hours worked each day by each employee.

On collecting further information from the personnel department you come across the following facts:

1. No-one starts work before 7.30am
2. No-one works later than 6.00pm
3. Times are always given in quarter-hours. This means that a person who clocks off at 5.55pm will be regarded as clocking off at 5.45pm.

Ignoring item 3 for the moment, you should go through the stages of solving the problem. Consider what will be the input, the output, and what processing must take place. Write the main body of the program. Think about the problems involved in calculation. Remember the complete work time will normally be made up of a morning session (clock-on up to 12) added to an afternoon session (12 till clock-off).

Program 4 shows a possible answer to the problem. Notice particularly the way in which it handles input, protecting against out-of-range numbers. However, it does not handle the quarter-hour specification. Let's add the quarter-hour facility. This sub-problem can be specified more completely as:

'When a person clocks in, the clock-in time is taken forward to the next quarter-hour, unless the person clocks in on a quarter-hour. When a person clocks off the clock-off time is taken back to the last quarter hour, unless the person clocks off on a quarter-hour.'



We need to add this section to the overall solution. We can indicate our intent to do this by adding line 45:

```
45 PROCfindquarterhour
```

This will need to be defined after line 500, beginning:

```
510 DEF PROCfindquarterhours
```

and ending with ENDPROC.

To decide on suitable coding, we produce our usual pseudocode based on the problem:

```
Make offmins = offmins DIV 15
Make offmins = offmins * 15
Make onmins = onmins + 14
IF onmins > 60 increase onhour by 1
Make onmins = onmins DIV 15
Make onmins = onmins * 15
```


This can easily be converted to Basic on a line-for-line basis. Readers should try coding this procedure.

Here are some more challenges:

1. Can you change program 4 so that it includes as input and output the name of the person? This can easily be done by adding an INPUT line and a PRINT line.
2. Can you alter the program to take account of a five-day week? This will involve adding the totals of each day together.
3. Can you alter the program to cope with a workforce of 10 people?
4. Can you alter the program to work out the weekly wage of each person if the hourly rate is included in the input section with the person's name?

This next program should start with an experiment. The first task is to get a candle, say two centimeters in diameter. Attach it to a secure base and mark two lines around the candle about 1 or 2cms apart. Light the candle and time how long it takes to burn down from the top to the bottom marks. This time will probably be in minutes. For Users without a stopwatch, simply enter this short program, then press SPACE to start timing, and RETURN to stop:

```
10 REPEAT UNTIL GET=32
20 TIME=0:REPEAT UNTIL GET=
   13:t=TIME
30 PRINTt DIV 6000" min: ";(t DIV
   100) MOD 60" sec"
```

Whatever the timing method, we will end up with the time taken to burn a certain quantity of wax. The quantity consumed can be found by the formula:

$$\text{quantity} = \frac{\text{pi*diam*diam*length}}{4}$$

For a first approximation we might use a value of 3 for pi.

The problem this experiment leads us to is:

Is it possible to take the data about one candle and from it predict the burning times of other candles?

Our first attempts will probably be inaccurate. In this type of problem, the accuracy of the computer output depends on the quality of our model. The model here is simply: 'The greater the amount of wax to burn, the longer will be the burning time'. This allows us to calculate burning time based on diameter (thickness) and length of candle. The model may not hold true for widely differing diameters of candles, and there are different hardnesses of wax, which will also affect the outcome. The program produced in answer to this problem will no doubt need refining, but it provides a starting point.

Considering our experiment, we need to produce a program that takes the test data (length, diameter, burn time) and the new candle data, then calculates the burn time for the new data. This falls into our three areas of Input, Process and Output. With the exception of having two input sections – one for test data and another for the prediction data – the main body of the program reflects this. Readers can create suitable input and output routines by examining program 5. The calculations required are quite simple:

1. Calculate quantity burned in test using previous formula.
2. Calculate actual quantity to burn using same formula.
3. Calculate predicted burn time by:

$$\frac{\text{actual quantity * testburntime}}{\text{test quantity}}$$

The resultant procedure is shown in lines 240 to 300.

To give the program a good tryout, select three candles: a birthday cake candle, a candle identical to the test candle and a really thick candle. Mark a top and bottom ring on each candle, making the distance between the rings 1cm on the thick candle, 4cms on the test candle duplicate, and 2cms on the birthday candle. Run the program three times with the data for the test candle and note down the predicted burn times for the three candles. Time each candle in turn, recording its actual burn time. Comparing the answers with the computer predictions will demonstrate the accuracy of the model.

Further exercises:

1. Can you alter the program so the test results can be permanently stored?
2. Can the program be altered (with permanently stored test results) to cope with three models:
   a. The thin long candle.
   b. The standard candle.
   c. The short thick candle.
3. Can you find out whether the type of wick plays any part in the speed of burning?
4. Can you devise a model that compensates for the type of wax?

Our last problem concerns the inhabitants of a distant world (the P&G? – Ed). On this planet the most advanced form of life is the Tibbar, a small furry creature. There are no predators to prevent the Tibbars increasing in population. This they do quite often, for a Tibbar will grow to maturity in four months, at which point it can start breeding. Tibbars have perfect litters of four Tibblets (two male and two female) which tends to produce a perfectly even balanced population. Program 6 shows how a model of population growth can be started. The interesting line is line 230, which increases the population every four months.

The trouble with computer models or simulations is that they are not perfect. They simulate the parts of real life we are interested in at the expense of other parts. The simulation of program 6, for example, looks only at an increasing population. There is nothing to take account of natural wastage. Another failing is that the program assumes that the population starts at two. This might not be the case – for example, if a herd of zebra is being monitored, a model might need to start with 12 or more creatures. There may need to be an imbalance of males to females, and the maturity period may need to be increased.

The main problem with such a model is that to provide a realistic simulation we must be aware of all the sub-problems that might arise, and how to solve them. Hence we have turned full circle.

We started solving simple problems directly, and have ended up thinking about producing programs which demonstrate their own weakness as solutions.

If we agree that the main aim of programming should be to help problem-solving, then every program, working or not, assists us on that road. Provided we constantly refine our ideas and learn from our mistakes, we will develop the strategies and skills to solve the many different problems that life brings.

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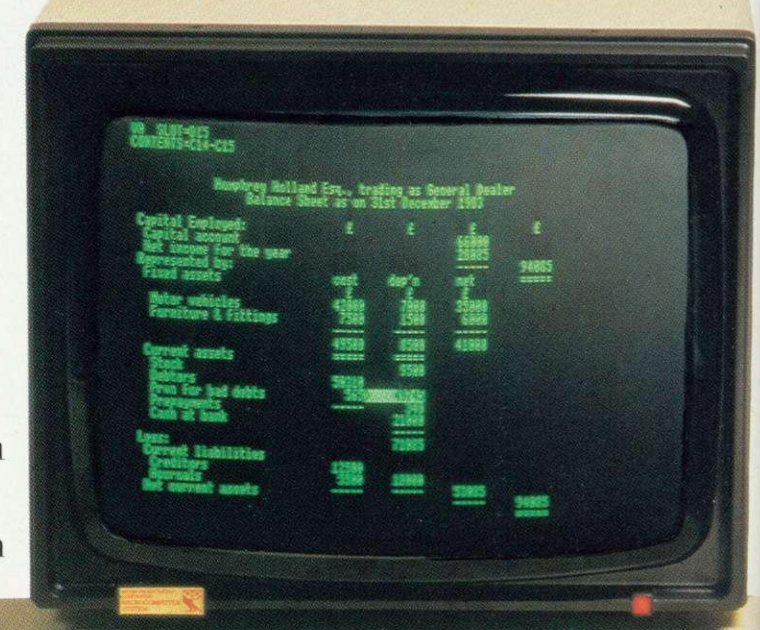
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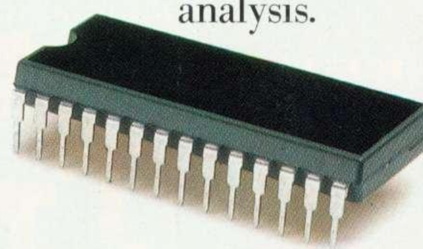
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SPRITELY CHARACTERS

Create your own full-colour cartoon figures in a flash with Harry Sinclair's sprite generator program
. . . and next month he'll show you how to animate them

THE GRAPHICS capabilities of the BBC and Electron are second to none. What Acorn calls medium-resolution graphics are called high-resolution by other manufacturers. The graphics commands and character redefinition facilities are excellent and are all that most people require. However, there are limitations. Redefined characters are single colour, animation is not easy, and large user-defined characters have to be made up of a number of standard-size units.

These problems can be overcome by directly addressing screen memory, although for some obscure reason Acorn regards this activity as being on roughly the same moral level as wife beating. Resolution, number of colours and size are limited only by the mode you choose and movement is considerably faster and smoother.

So why don't we use this method all the time? Well, Acorn has not provided facilities for making it easy and so to take full advantage of the method you really need to use machine code, which puts people off.

Two main facilities need to be provided:

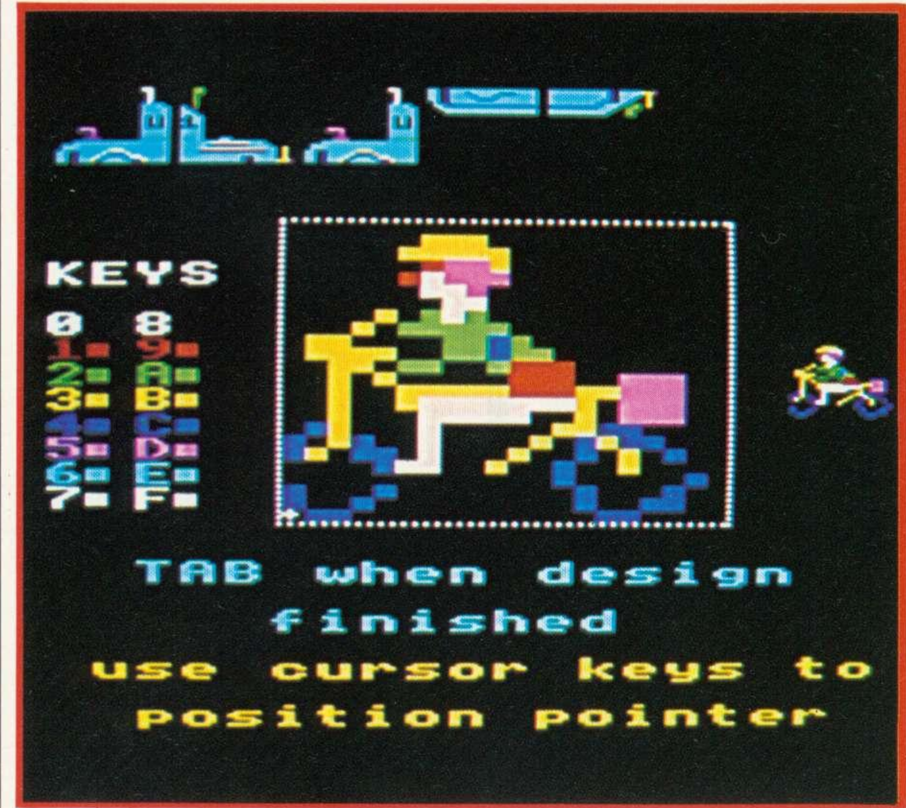
- Routines that allow the user to create characters (sprites) without having to perform the rather messy manipulations required to change the colour of each pixel.
- The means to move these creations to any screen location quickly and without worrying about internal screen boundaries.

This article introduces a program which performs the first of these tasks, and next month I'll present a program that takes the output from this month's program and moves it around the screen smoothly without disturbing any background, maintaining your character's original colouring at all times – EOR printing is not used.

Your characters can be as large as 24 pixels deep by 20 pixels wide or as small as one pixel – in which case I will be exceeding miffed, having toiled through many a night, these wonders to bring you.

The programs are designed in such a way that it is not necessary to understand how the whole process operates or to know anything about assembler. If you either know all about these matters or don't want to know, you can get on with typing in the *Design* program after reading the next section.

All you need to know – and this is only for using the output of the first program – is the way graphics co-ordinates are actually arranged. In all the graphics modes (0, 1, 2, 4 and 5) the Beeb regards the screen as being 256 bytes deep (Y axis), with 0 at the top of the screen and 255 at the bottom. The X axis has two possible ranges – 0 to 39





Easy Rider was designed using the largest grid and is shown at its final size on the right. Colours are selected from the palette (left) by moving the cursor to the appropriate position and pressing a number key

The Design program is listed on yellow pages viii-ix, with full entry and conversion instructions on page x

for modes 4 and 5, and 0 to 79 in modes 0, 1 and 2. This explains why mode 2 (256 bytes deep by 80 bytes wide = 20k) requires twice as much screen memory as mode 5 (256 bytes deep by 40 bytes wide = 10k). These programs use mode 2, so to position your sprites on the screen you should use values in the range 0 to 79 for the X axis. The way to call up sprites is:

1. Run the *Design* program and design your characters.
2. Allow the program to save them.
3. Type ?&70 = (the number of the character you want to show).
4. Type ?&71 = (X axis number).
5. Type ?&72 = (Y axis number).
6. Type MODE 2:CALL display.

Note that 'display' is an assembler routine within *Design*. This will provide only a static display – no animation (except by clever use of flashing colours). Next month's program will allow two sorts of animation – movement of individual sprites and multi-frame animation using a sequence of sprites as in a cartoon film. OK, if you don't want to read the next section on how the program works, start typing *Design* in now.

How the program works

Mode 2 allows the use of all 16 colours (0 to 15) and so there are two pixels per byte. This is because the number of each colour has to be written to the screen memory byte in a particular format. Each byte is made up of eight bits. Four bits are necessary to represent numbers in the range 0-15 so you can fit only two such numbers in each byte.

Say you want a particular screen byte to be magenta (colour 5) on the left half and flashing blue/yellow (colour 12, or &C in hexadecimal) on the right. Sending the value &5C to the byte does not work. What you have to do is interweave the colour numbers in a special way.

Magenta	*Blue/yel*	
0	1	1st pair = 01
1	1	2nd pair = 11
0	0	3rd pair = 00
1	0	4th pair = 10

Table 1. How to interweave the colour numbers in binary

The first step is to convert each number into its binary equivalent. Five is 0101 and 12 is 1100. The method is then to take the left-hand (most significant) bit of the first number, the first bit of the second number, the second bit of the first number, the second bit of the second number and so on. It sounds complicated but if you just write the numbers in binary vertically next to each other and read off the pairs it's very easy. Table 1 shows how this works in our case, where the final number is 01110010. Rather than convert that number into a decimal number it's much easier to convert it directly into hex. Just consider each half of the byte as separate so that you have two numbers – 0111 and 0010. Each will now convert into a single hex digit in the range 0-F. In this case you will get 7 and 2. The final hex number is therefore &72. If you're not very happy about converting from one number base to another table 2 gives all the required values. *page 77* ▶

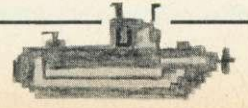
dec.	*bin.*	*hex.*
1	0001	1
2	0010	2
3	0011	3
4	0100	4
5	0101	5
6	0110	6
7	0111	7
8	1000	8
9	1001	9
10	1010	A
11	1011	B
12	1100	C
13	1101	D
14	1110	E
15	1111	F

Table 2. Conversion table for decimal, binary and hexadecimal

DESIGN PROGRAM DESCRIPTION

10 to 200 Perform initial housekeeping – clearing work areas, assigning constants, defining the characters used in the program as the representation of a pixel (CHR$240) and the pointer/cursor (CHR$241), assembling the machine code, and setting up 'key$', which is used to find out which colour control key has been pressed.
210 Starts the outer loop, which is used each time a new sprite design is started.
220 Works out where to store the data for each design by looking at the appropriate entry in the table of addresses starting at &12F0.
230 to 240 Draw previous designs across the top of the screen, having calculated the gap required between each design to give even spacing. This is necessary since designs can be anything between 8 and 20 pixels wide.
250 to 270 Print out the details of the colour control keys.
310 to 350 Position the 'design box' centrally, draw it, and draw the pointer/cursor in the bottom left of the box.
360 Start of the inner loop, which controls cursor movement, colour change and the creation of the data table for each design.
370 Checks whether a key has been pressed and, if so, whether it appears in the string variable 'key$'. If one of the appropriate keys has been pressed, K% will contain the number of its position within the string – eg if 0 has been pressed K% will equal 1 – the position of 0 within 'key$'. If F has been pressed K% will equal 16. If a non-acceptable key has been pressed K% will equal 0. Caps lock *must* be on.
380 Sets col%, the colour required, to equal K% – 1 and draws the representation of a pixel in the correct place and in the correct colour.
390 to 420 Check if any of the cursor control keys have been pressed and, if so, delete the cursor/pointer at its present position, adjust the X and Y co-ordinates and draw it in the new position.
430 The end point of the inner loop, which is exited when the TAB key is pressed.
440 Updates the number of the character ready for the next design and ensures that character 2 is the same as character 0 and character 6 the same as character 4.
450 Reactivates the text cursor, clears the text window and switches off the flashing cursor.
460 to 480 Exit conditions for the outer loop. These are:
1. Memory full
2. CTRL-Z pressed

Pressing SPACE allows a new design to be started unless condition 1 is true.
490 to 510 Re-enable the edit keys and switch to mode 7.
520 to 530 Provide information on the whereabouts of the data tables for the characters you have designed.
540 to 550 Allow you to save your data.
560 to 570 End of main program.



The task of interweaving numbers in this way would be quite tricky, if not impossible, from Basic but is fairly simple in assembler, where individual bits can be manipulated.

Well, that's all there is to the control of pixel colours. Layout of screen memory is the next item. I don't propose to go into any great detail in this article but it is useful to have a general understanding of the subject. Type in the following short program.

```
10 *TV255
20 MODE 2
30 FOR I% = 0 TO 8
40 I%?&4900 = &72
50 G = GET
60 NEXT
```

All this program does is to send the value &72 to 9 (0 to 8) consecutive screen memory locations starting at &4900. When you run the program the first byte will light up with the left-hand pixel in colour 5 (magenta) and the right-hand pixel flashing blue/yellow. Each time you press a key the next byte will light up.

You will notice that the first eight bytes are arranged vertically but that the ninth appears immediately to the right of the first byte. In fact, if you change line 30 to read FOR I% = 0 TO 639 and delete line 50, which just waits for a keypress, you will see that the 640 bytes form a strip across the screen 80 bytes wide and eight bytes deep.

A mode 2 screen is made up of 32 such strips. Within each strip vertically adjacent bytes are consecutive – that is, the number of any byte is one greater than the byte above. Since each strip is eight bytes deep it follows that the difference between horizontally adjacent bytes is eight. The difficulties arise when you want to put a sprite on the screen which will occupy parts of more than one strip.

There are a few ways of dealing with this problem and that will be the subject of the next article. The important point to appreciate here is that your character data should be organised in such a way that it reflects the organisation of screen memory. This ensures that you can then select the most efficient way of writing it to the screen. The method I have chosen means that instead of having to calculate the address of either each individual byte or each

PROCEDURES

580 to 630 PROCpntr(X%,Y%)
Uses Exclusive OR (GCOL3,7) plotting to draw the cursor. This ensures that it can be seen no matter what the background colour and that redrawing it in the same position will delete it.

640 to 720 PROCdraw(col%,X%,Y%)
This is the heart of the program. Apart from drawing CHR$240 – the representation of an enlarged pixel – in the chosen position and in the appropriate colour, this procedure passes parameters in lines 670, 680 to the main machine code routine, 'byte-number', and then CALLs it. A description of this routine appears below.

730 to 770 PROCwind-up
This is the error-handling routine. It can be deleted when you have de-bugged your program.

780 to 930 PROCsave
Sets up a parameter block starting at &3000 containing details of your data file – name, start address, finish address etc – and then calls OSFILE at &FFDD with 0 in A% and with X% and Y% pointing to the parameter block. This saves your data for you.

940 to 2920 PROCassemble
This sets up the machine code routines. In order these are:

980 byte-number
This routine has had parameters passed to it by PROCdraw. &88 contains the number along the X axis of the pixel to be altered – ie, its column number. The leftmost pixel is number 0. &89 contains the Y axis number of the pixel – its row number. The top row is 0 and the bottom 23. The routine has two purposes. It calculates the position in the data table of the byte to be altered using the formula byte-number = (X DIV 2)*8 + ((Y DIV 8)*8*W) + Y MOD 8, where W is the width of the character in bytes and X and Y are the co-ordinates. The result is stored in &8F and &8D. The second objective is to work out in which 'strip' of screen memory the altered byte should appear. Possible answers are 0 for the first strip and 1 or 2 for the second and third strips respectively. These values are stored in the X-register (not to be confused with the X axis) and control the operation of the routine 'pixad' starting at line 1690, which calculates the base address for a further routine 'store', which displays your character actual size as you design it.

1290 byte-value
PROCdraw has changed the dummy addresses (&8000 at lines 1320 and 1610) to the address of the start of the current data table. The byte to be altered is loaded into the accumulator. If the X axis number is odd then the pixel to be changed is a right-hand one, otherwise it is a left-hand one. Lines 1420 to 1490 or lines 1510 to 1580 filter out the old colour bits and replace them with those of the new colour, contained in &87.

1590 store
This places the new byte value in the correct position in the data table and also displays the new pixels on the screen.

1860 display
Displays designs across the top of the screen. Line 240 passes 3 parameters to this routine:

1. &70 Contains the number of the character
2. &71 X axis position (0 to 79)
3. &72 Y axis position (0 to 255)

The first part of the routine calculates the screen start address of each of the three strips for each character using the formula:

strip 1 = &3000 + (640*(Y DIV 8)) + (8*(X DIV 8)*8)
strip 2 = strip 1 + 640
strip 3 = strip 2 + 640

Lines 2420 to 2490 search the address table starting at &12F0 for the low byte of the start address of the character data table. This is put into &88. A loop then increments the low byte by the block size – ie 8* width – the number of bytes to be written to each strip – contained in &12EF – and puts the results into &8A and &8C. The next loop takes the high byte of the character address and puts it into &89, &8B, and &8D. 'Mainloop' now reads from the data table and inserts it into the appropriate screen memory addresses, using the Y register to index.

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***Greek**	It's all Greek to me too!
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***Maths**	A mix of until now unobtainable Mathematical symbols.
***Miscellaneous**	A few oddities which often are very necessary.
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Large picture shows BBC Computer System and a Quickshot II Joystick. Small inset just a few of the joysticks that will work with the patch lead. Screenshot by kind permission of SUPERIOR SOFTWARE

horizontal row of bytes, you need only calculate the start address of each strip to be written to.

You may be relieved to know that the first program does all the calculation of byte values and organises them into tables for you. All you have to do is the creative bit.

How to use the program

Now for the sprite design program in this issue. When you run it you'll be asked how wide in pixels (8 to 20) you want your character to be. Having selected this you will see a box within which you design your character, at approximately four times magnification. As your design progresses it will also be shown actual size to the right of the box, while all your previous designs are shown actual size across the top of the screen.

The keys to control colour are displayed on the left of the screen. They correspond to the hex number of each colour, so pressing 1 gives colour 1 and pressing F gives colour 15. The list of colours is itself colour-coded so you don't have to remember numbers or keep referring to the *User Guide*.

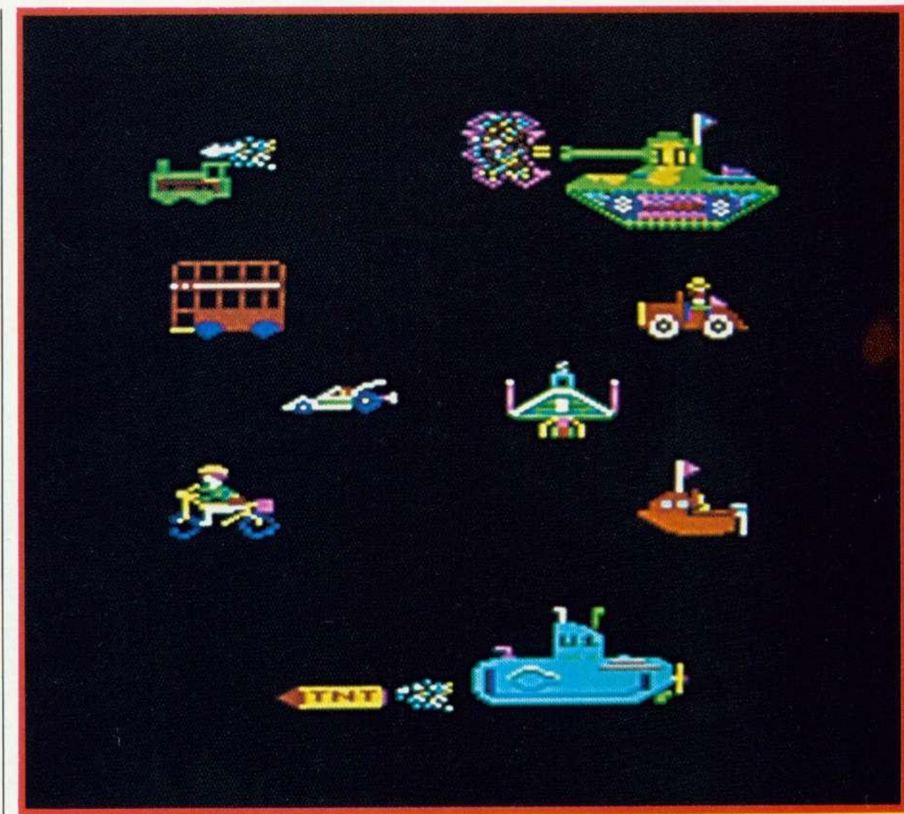
To change the colour of any location just move the cursor over it, using the cursor control (arrow) keys, and press the appropriate colour key. You can make any alterations you want to the current design at any time.

When you've finished a design just press the TAB key. You will then be asked whether you want to do another design or stop. You can have up to six separate designs per session, although for reasons that will become apparent next month, these six designs are treated as being eight designs. Character 2 is the same as character 0 and character 6 is the same as 4.

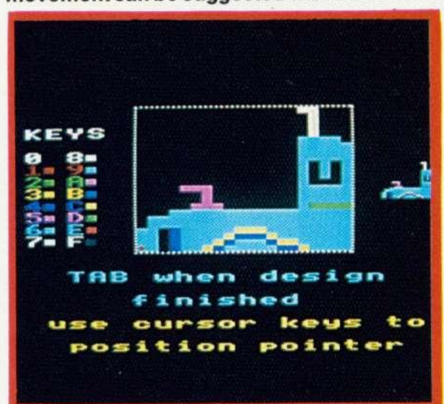
When you have either filled up available memory or have decided to stop you'll be given information on the number of characters defined, the address of the data in memory, and the location of the table of addresses of the start of each character's data block. You don't have to make a note of all this information – it's just to reassure you. You will then be asked if you want to save the data. If you don't, the program finishes. If you do, you are asked what you want to call the data file.

After this you are given an opportunity to get your tape ready or insert the appropriate disc and then the data is saved automatically. It doesn't matter whether you're using cassette or disc.

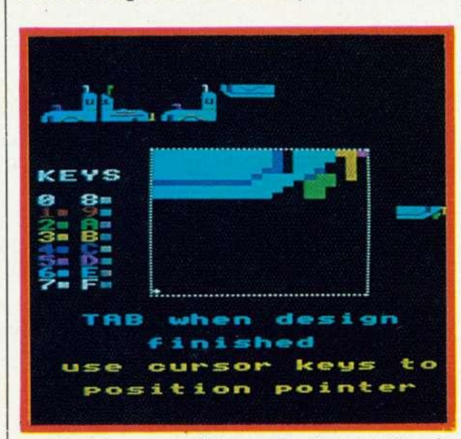
The filing system in use is important, however, in that it affects the default setting of PAGE. The program *must* be loaded and run with PAGE set at &1900. Disc users will probably have PAGE set



Some of the spritely characters from Harry Sinclair's portfolio. By combining four 'quartered' designs, such as the tank and submarine, a larger character can be created, and movement can be suggested with the use of flashing colours



Designing a multi-sprite character. Stage 1: the conning tower takes shape . . .



. . . Nearing completion. The last section is put together. The other quarters are shown 'saved' at the top for reference, awaiting assembly of the complete model

to this anyway but machines using cassette or those fitted with Econet will have to have their default setting altered by typing in PAGE = &1900. If you have Econet you'll also have to type in ?&224 = &A6 to disable it before loading, otherwise the program may be corrupted, since it occupies Econet workspace. It is also advisable to add a line 0 as follows:

```
0 REM ******
```

When the disc drives are used on an Econet machine bytes &1905 and &1906 seem sometimes to be corrupted even when Econet is disabled, but this extra line will make that unimportant.

Next month I'll give you a number of extra procedures that let you edit previously designed sprites, produce 'clones', mirror images and so on. It isn't possible to include them here as the program only just fits into available memory as it is. However, removing PROCassemble and loading the machine code separately should provide enough room for these additional facilities.

Remember to set PAGE to &1900 before you type the program in and save it before you attempt to RUN it, just in case PROCassemble runs amok and starts assembling code all over your hard work. Better still, you could get this month's cassette and save yourself a lot of typing.

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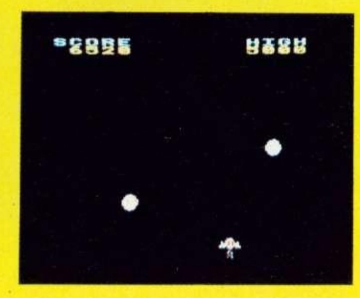










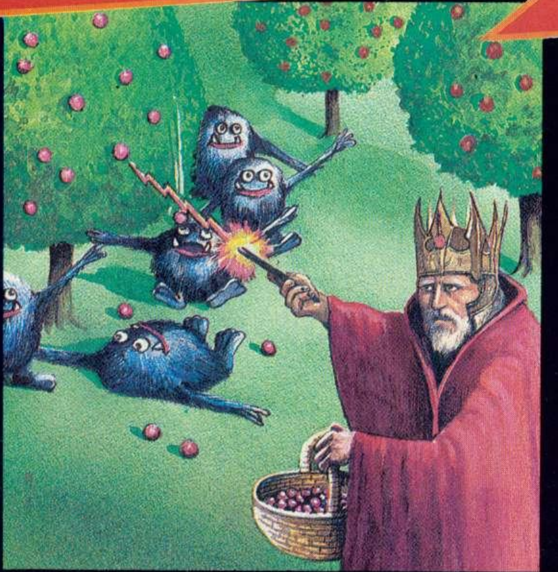




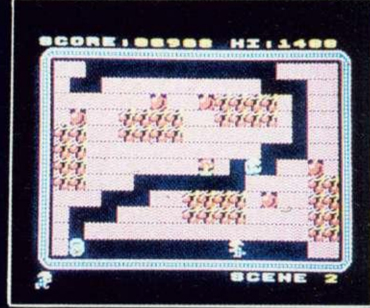
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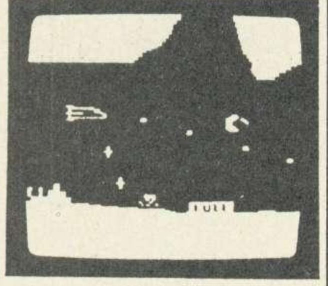
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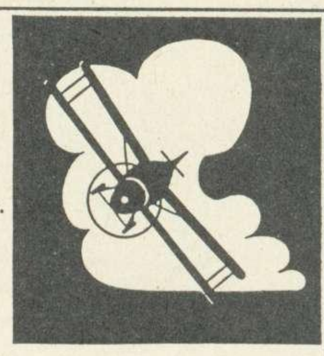
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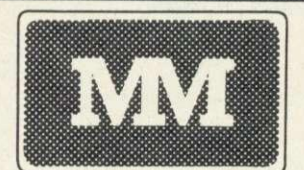
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MAD ALEX GETS AMICABLE

Simon Dally delivers another problem cooked up by the demented dungeon-dweller.

Can you find the combination to Kitty's Kitchen by juggling amicable numbers?

THIS month you find yourself back in the *Acorn User* dungeon. As you trace your path beneath the sewers of Long Acre, brushing aside the debris of centuries of Covent Garden vegetables and failed competition entries, you notice a sign with an arrow pointing upwards and a placard proclaiming The Freemason's Arms. 'Verily there be magicke afoot here,' you tell yourself as you thrust aside the manhole cover. And God's teeth, who should confront you, stuffing himself with bangers and chips (especially the latter), with beans only 30p extra, but your old adversary Mad Alex!

Having ordered your wild boar's head with potter sauce and ward stuffing you satisfy yourself that for once in his miserable life Mad Alex is in dwarf mode!

Newcomers to the dungeon may need reminding that dwarves invariably tell the truth at all times and trolls always lie. Now, Alex explains to you as he quaffs another hogshead of Bull's Blood, he will introduce you to another breed in the dungeon – the gremlins!

A gremlin, you learn, is somewhere between a dwarf and a troll – but you never know quite where you are with them. Sometimes they lie. Sometimes they tell the truth. 'Filthy brutes,' growls Mad Alex, scooping up his beans with a piece of veroboard, 'just like certain computer manufacturers I know . . .'

With his soldering iron, Mad Alex burns into the solid walnut veneer of the table the problem you have to solve before he will escort you further. Actually, he ripped it off from *Acorn User* reader Trev Buck, but he doesn't like to admit it. It goes as follows:

'A pair of amicable numbers are those where the factors of the first number (apart from the number itself) sum to give the second number; and the factors of the second number (apart from the number itself) sum to give the first number. However, a number cannot be 'self-amicable' – eg, 6 is self-amicable as 1+2+3=6. The first pair of amicable numbers is 220 and 284. The problem is to find the next four pairs.'

Mad Alex scratches his gold earring and says, 'Trev has written a program in BBC Basic which finds them in 1 hour 13 minutes and 10 secs. I'm trying to do better'.

For our purposes the numbers will be referred to as Amicable 1 (220, 284) Amicable 2 (the next pair), etc.

Mad Alex explains that in each of the corners of the room he is about to show you there is a dwarf, a troll and a gremlin. There is one exception: in corner 3 he has had to zap a recalcitrant troll who was trying to steal his makeup – so there is only a dwarf and a gremlin there. In each case you must identify who the gremlin is and follow only his instructions. If you do the puzzle correctly you will end up with the number of the combination lock to Kitty's Kitchen, where untold culinary (and other) delights await you.

You start off with the number 10,000 as your combination.

Corner 1

A: I am a gremlin. Add the numbers of Amicable 2 to your combination.

B: A speaks the truth. Subtract the lower number of Amicable 2 from your combination.

C: I am a gremlin. Add the higher figure of Amicable 2 to your answer.

Corner 2

A: I am a gremlin. Add the higher figure of Amicable 3 to your answer.

B: A speaks true. Add the lower figure of Amicable 3 to your answer.

C: I am not a gremlin. Add the difference between the two Amicable 3 figures to your combination.

Corner 3

A: Add both Amicable 4 numbers to your combination.

B: Subtract the lower Amicable 4 number from your answer.

You ask A whether B is a gremlin. From his (Yes/No) answer you can deduce instantly which is the gremlin and which is the dwarf.

Corner 4

This is the most difficult corner of all. The three characters speak in a tongue called Acornspeak (unknown to you), and Alex (who is a bit of a tease) has to translate for you. First they speak in English.

A: Multiply your answer by the lower figure of Amicable 5.

B: Add the higher figure of Amicable 5 to your number.

C: Subtract the higher figure of Amicable 5 from your number.

Each then makes a declaration that Mad Alex 'interprets' for you.

He says that A announces either that C is a troll or that C is a gremlin, but he (Alex) won't tell you which. Then he tells you that B says A is either a dwarf, a troll or a gremlin but again he (Alex) won't tell you. Finally C speaks up and Alex says C has declared which category B falls into but again he (Alex) won't tell you which of the three it is. But being a perfectly logical being, bitwise, he (Alex) has already fathomed out which is which!

With the greatest restraint, and mindful of your desire to get into Kitty's Kitchen, you point out that while he may know which is which, you don't have enough information to go on. Alex then relents and tells you exactly what A said – and now you find you know what type each character is without a shadow of doubt.

What is the combination to Kitty's Kitchen?



Answers on a postcard please to arrive not later than October 5, 1984 to:
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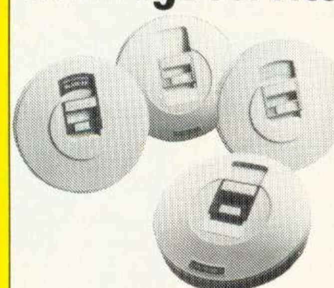
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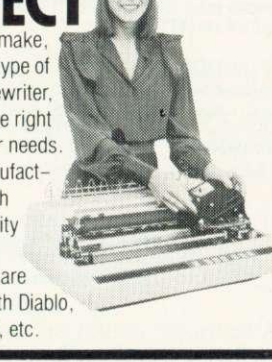
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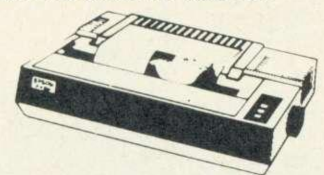
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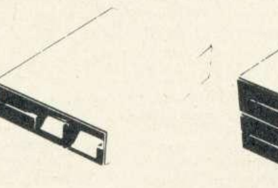
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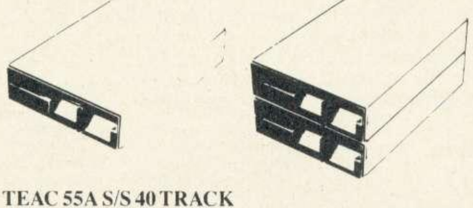
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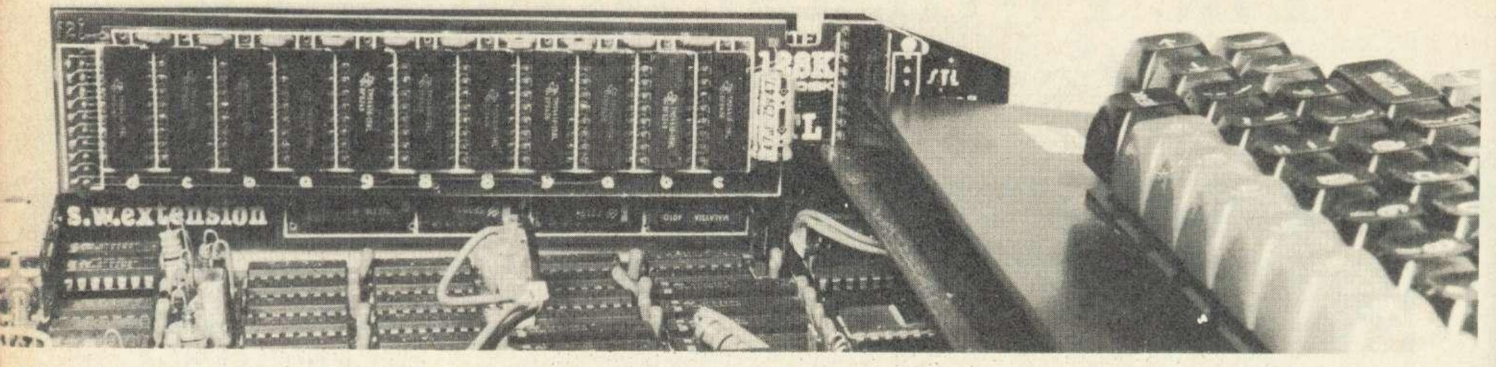






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HOW ABOUT COMPATIBILITY?
The Sideways RAM is completely compatible with all issues of BBC computers, disks, all sideways ROMs, second processor, Torch disk pack, Teletext, Econet etc. but NOT with ROM extension boards, since it can replace them.

Its power consumption is so low that you can use it in conjunction with twin disks.

HOW DOES IT WORK?
Occupying the same place as sideways ROMs (such as BASIC, DFS, CPN etc), it is treated like other Sideways ROMs and therefore can replace them.
The Machine Operating System uses Sideways RAMs as naturally as Basic, without procedures or programming rules.
Sideways RAM can run any language, any filing system including Hi-Basic and second processor DFS.

SIDEWAYS RAM POWER IS IN THE SOFTWARE:
Different from Sideways ROMs, Sideways RAM can be written into. This property gives birth to a NEW GENERATION of software for the BBC computer: SERVICE RAMs and VIRTUAL MEMORY PROCESSOR.
Each SERVICE RAM has its own commands and code as its counterpart Sideways ROM but has its own private workspace and storage area thus leaving you with the lowest possible PAGE value (PAGE=&EOO). On the other hand, the Virtual Memory Processor can run huge MACRO BASIC programs (Megabytes are not the limit), keep them on disk and uses the basic 32k of RAM as transient program area. All software for the Sideways RAM system is free.

FREE SOFTWARE?
Solidisk Sideways RAMs is bundled with lots and lots of software, FREE and we mean FREE, now and later. It is quite simple: for every Sideways RAM sold, £1 is spent on MORE software. Sideways RAM users are invited to spot new applications and contributions are rewarded at the usual rate of £1 for every 4 bytes of machine code.
The result is printed on the opposite page.

HOW ABOUT THE FUTURE?
Solidisk Sideways RAM is also widely used in schools for ECONET stations, by professional programmers for writing programs, research laboratories for RAM disk data base, at home for wordprocessing and now even games.
New areas are being developed: Telesoft and Teletext logging, Speech Processor assembler and Relational Data base to cite a few.
As the price of 16k EPROMs are as high as £20 at the present time, more Sideways ROM software publishers will be willing to sell their software on disk. Solidisk will mail FREE OF ANY COST their advertisement to ALL Sideways RAM users providing the price of the Disk version reflects savings in the cost of the ROMs. Solidisk believes that the majority of BBC users will have their Sideways RAM fitted before the end of next year.
Also unlike other makes (SIR, APTL, WE Sideways ROM/RAM extension boards and the Aries B20), Solidisk Sideways RAM is expandable from 16k right to 128k and now to 208K. As a result of VLSI technology and volume of sales, Solidisk products also have a lower shop price than any other products.

OTHER PRODUCTS FROM SOLIDISK:
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Uvipac is powered by the mains, simple to operate and can erase 3 Eproms of any type in just 15 minutes. Uvipac is ideal for home use.

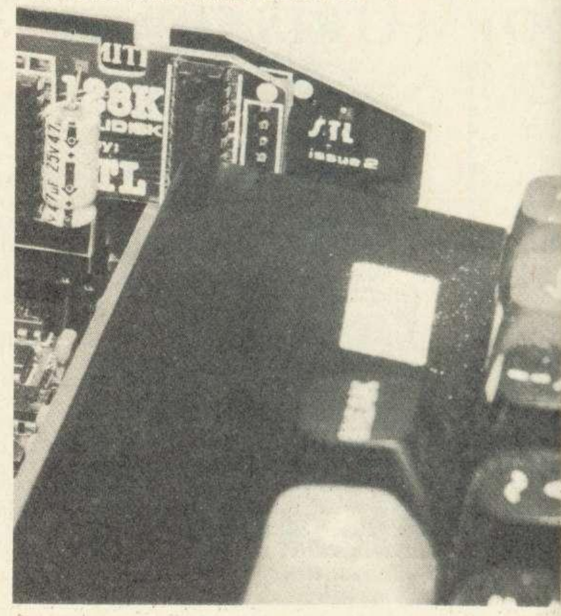
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Remove the keyboard from the BBC computer and instal it in the new case. Replace the old 3" keyboard tail by the new 24" cable and you can work really in comfort even for very long hours. The keyboard case is more a productivity tool than just ergonomics.

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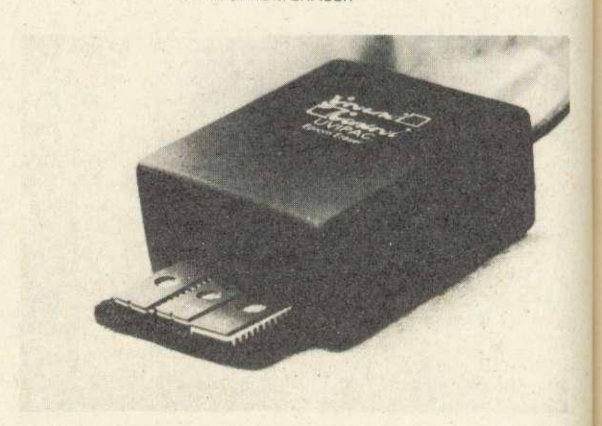
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WHICH SIDEWAYS RAM DO YOU NEED?

Solidisk Sideways RAM is available in 16 (SWR16), equivalent to 1 sideways ROM, 32k (SWR32), equivalent to 2 sideways ROMs, 128k (Solidisk), equivalent to 8 sideways ROMs and the 208 Solidisk equivalent to 12 Sideways ROMs. You can buy a small Sideways RAM now and upgrade it later. From the SWR16 to the SWR32 is by straight exchange, from the SWR32 to the Solidisk is by adding the 96k Solidisk Extension, from 128k to 208 is by exchange of the RAM card.

FREE SOLIDISK SOFTWARE:

WORD64:
WORD 64 is a Service RAM, it uses Solidisk as storage for WORDWISE, up to 64K free characters for any text.

SILEXICON:
SILEXICON is a Spelling Checker for Solidisk. SILEX scans texts at more than a 1,000 words a minute and compares each word against the dictionary, Silexicon marks the mis-spelt words for either addition to the dictionary or eventual correction.

PRINTER BUFFER:
PRINTER BUFFER is a Service RAM, it increases 500 times the normal 32 bytes printer queue to 15K bytes, completely transparent to the user. PRINTER BUFFER is as useful for printing a long document as for a short program listing.

STLEOO:
STLOO is a Service RAM, it is Disk Filing System that leaves PAGE at &EOO, has built-in disk formatter/verifier and automatic track stepping for 40/80 track disk drives.

STL150:
STL150 is a Service RAM to enhance Acorn's .90 DFS to offer up to 150 directory entries per side.

STL-RFS:
STL-RFS (RAM/ROM filing system) is a Service RAM and an innovation in portable applications. STL RFS saves any program in a Sideways ROM format, it can then be copied onto EPROM to give instant recall of your programs. Plug this EPROM into any sideways socket, type *RFS and it runs itself. Compatible with the ELECTRON and BBC, tape and disks, SWR16, SWR32 and Solidisk.

INDEX:
INDEX is a Service RAM, it stores all the entry points of one or several sequential data files such as mailing list, stock list, accounts etc, merges, sorts them in alphabetical order and gives instant access to any record. INDEX can handle 1,100 records of any size, any type, any number of fields.

MACRO-BASIC:
MACRO-BASIC is a program generator. You use a wordprocessor to create a command file which is then scanned by MACRO. MACRO uses other programs, subroutine libraries, text files (actually any or all files on your disks) as source to generate a bug free BASIC program which can be very large (Megabytes are not the limit).

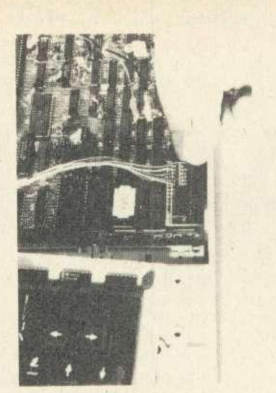
VIRTUAL MEMORY PROCESSOR:
VIRTUAL MEMORY PROCESSOR (VMP) uses extensively overlay technique and Solidisk as back store for very large programs that cannot be run otherwise. VMP uses the 32k basic RAM as transient area: it operates on a Main Program as generated by MACRO-BASIC, taking different segments from the Solidisk Store, POOL, HOLD, FREE or CLEAR segments from the transient area. For example: VMP will accept 20 segments of 10k of Basic assembler and assembles it into 16k of machine code.

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MENU puts all computer's resources at your fingertips. MENU displays your Sideways Firmare, Disk Directories, Sideways RAM system, Solidisk System etc.

MORE FREE SIDEWAYS RAM SOFTWARE TO COME:
While others are making promises for software to be written, Solidisk Systems RAM comes with a complete, novel and powerful software package including compatibility with existing sideways software.
Each Sideways RAM is accompanied by the Sideways RAM User Manual, full 1 year warranty, 1 utility disc* and free mailing on all new publications from the Software Support Service.

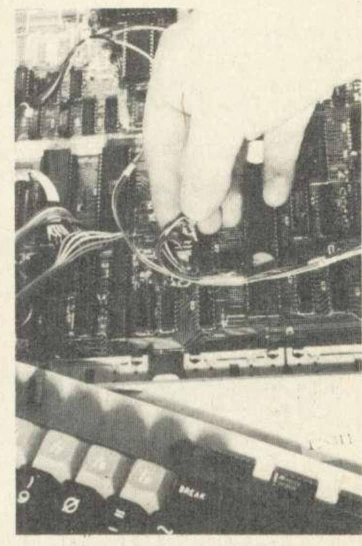
*It should be understood that we cannot put as much free software on a 40 track single sided as on 80 tracks. The present software package require 160 tracks of storage and can be accommodated on ONE 2 X 80 track double sided diskette, only the most useful programs are supplied on other formats (ie 40 track single sided, 2 X 40 track double sided, 80 track single sided). Should you require the whole collection of free software, please place an order for extra disks.
For the technical minded: the Source Code and Technical Manual (3 floppies and a 300+ page book) price = £10, the SILEXICON EXTENSION PACKAGE (3 floppies and a 40 page mnual, 30,000 word dictionary: English and French now, German and Spanish planned) price = £9.00. '4S' also publishes regular updated SWR utility discs at £3.00.
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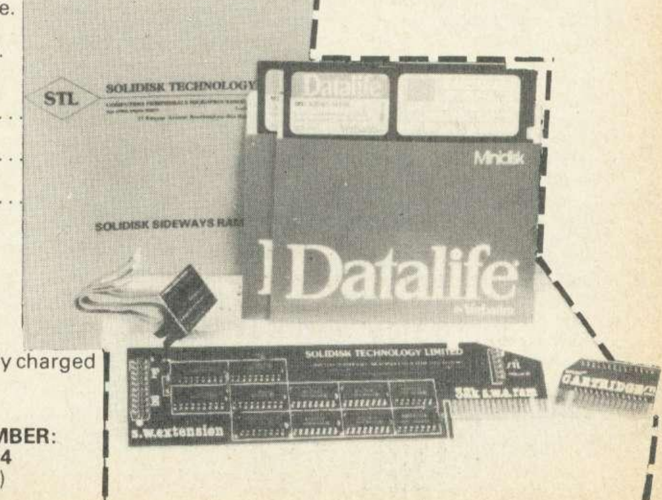
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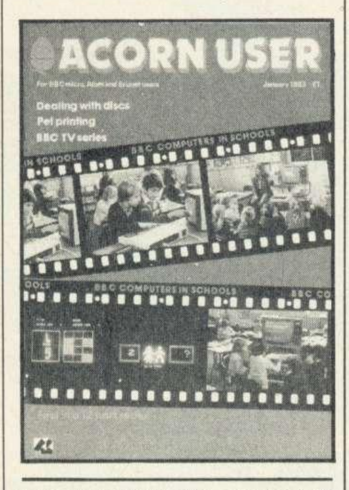


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6. January 1983 MEP school launch. *FX commands for sound. Second BBC TV series. Machine code 3 – two pass assembly. Disc drives for the Beeb. Programming forum. Program protection. Micros in schools – new series. Commodore Pet printer used with Beeb. BBC programs written on an Atom. Extra Atom memory.



7. February 1 MHz bus examined. 3D Atom graphics. Atom BBC Board reviewed. Machine code 4 – memory. BBC Computer Literacy update. Atom error handling. Micros in schools 2 – getting organised. Hints and Tips. Beeb Forum. Reviews of *Wordwise* and the Amber printer. ***

8. March Chess on the BBC micro. Sound on the Beeb. Printers for beginners. Atom analogue converter. Schools 3 – micros and maths. Machine code 5 – indirect addressing. DIY lightpen. MEP's *Microprimer* review. Atom Ross toolkit review. Beeb Forum. Assembly language and Pascal book reviews. ***

9. April *Hexangle* game listing. Bach on the Beeb. Hints & Tips on disc drives. Machine code 6 – the CALL statement. Interfacing the 1 MHz bus. Schools 4 – young children and micros. Graphics listings. Printers for beginners 2. Reviews fo BCPL, educational software and Atom software. ***

10. May Review of Basic II. Graphics listings. New *FX calls in OS1.2. Colour mixing on the Beeb. Jazz, blues and folk on the BBC. Schools 5 – language development. DIY Beeb interface box. Atom sound board. A to Z of printing: how to get going. Hints and Tips: PROCs, discs and FNs. Printer, software and book reviews.

11. June Techniques series – sorting. Hints and Tips: 50p network. Drawing techniques and CAD. Machine code: interrupts. Schools 6 – information technology. Atom Forum. Beeb Forum. Printers – write your own graphics dumps. Comparitive review of *View* and *Wordwise*. Three graphics packages reviewed. Test of *Acorn User*'s interface box.

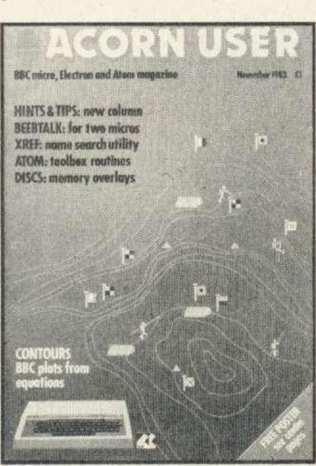
12. July Techniques – hash tables. Hints and Tips: logic made easy. Recursion and graphics. Handling strings. Two ideas for passing variables. Beeb aids the blind. DIY second keyboard. Beeb Forum. Sounds on the Atom. Hardware, firmware, software and book reviews. Atom Forum.

13. August Printer graphics and dumps. Techniques – Tree structures and sorting. All the fun of the fair. 40/80 disc copier. Colour painting. Basic II: random access files. Screen dumps for Olivetti, Centronics and Seikosha. Atom strings. Reviews of Tandy CGP115 printer, five educational packs, A to D converter.

14. September Techniques – ink-blots and mazes. Painting by lightpen. DFS space explored. Beeb Forum. *Mega Monsters* game listing. Machine code graphics dumps. Atom Forum. Atom cassette recorder check. Reviews of Atom RAM boards, Cumana disc manual, *Logo* for schools, Hobbit floppy tape and books.

15. October Women and computing. Techniques – random numbers. Review of Computer Concepts' *Beebcalc*. Fractal graphics. 57 files on 40 & 80 track discs. *Vampire* game listing. Beeb Forum. Assembly code controls tab key. Osfile merging. Atom future. Atom verify routine. Reviews of *Vu-Type*, Procyon Atom book, Epson FX80, Teletext adapter, disc drive, software.

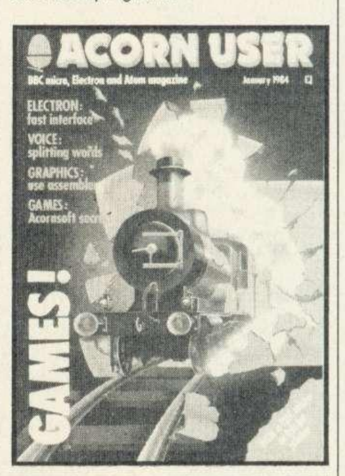
16. November Techniques – impossible problems. Contour graphics. Connecting two Beebs together. XREF: sorts & lists variable, function and procedure names. Assembler ultilities in Basic II. OS, VDU, *FX, OSBYTE calls – **pull-out poster**. Disc overlays. Adding extra Atom commands. Reviews of 7 educational packs, Atom ROM, books, games.



17. December Random graphics. Animated graphics in colour. Techniques – graphs. Hints & Tips. Universal printer dump. 6522 connected to the Electron. Saving machine code. Beeb Forum. Graphics **pull-out poster**. **Index:** July 82–July 83. Forum Extra: EQUS. BBC helps the disabled. Schools – data processing. Transferring data between Beebs, Atoms . . . or Pets. Atom block demolition utility. Atom disassembler program. Reviews of software, books, educational programs from Chalksoft.



18. January 1984: Games special issue Techniques – graphs part 2. Stacks and queues, Basic and languages. Hints & Tips. Voice chip revealed. How to write games. Electron interfacing. Beeb Forum. Life graphics routines. *Defencecom* game listing. *The Train Game* listing. Machine code graphics. Where to put machine code. Schools – handling data. Juki daisywheel printer examined. Atom Forum and adventure. Reviews of ultilities, software, *Beeline* wordprocessor, educational packages, two chess programs.



19. February: Adventures special issue Techniques – efficient sorts. PROC for a numeric keypad on the Beeb keyboard. 12 graphics listings. Random access filing on disc. Locking files. MCP40 printer/plotter looked at. Hints & Tips. Beeb Forum. Make discs readable on 40 and 80 track drives. Screen memory organisation. Hints on adventure design. Adventure action. Adventure ideas in computer language. Text compression. Word-crunching. VIA chip on Electron to drive a parallel printer. Atom Forum. Schools – simulation packages. Reviews: *Disc Doctor*, Leasalink's DFS upgrade, Hitachi's microdrive system, Solidisk's sideway RAM board, software.

20. March Utility: timing routine. Fractals. Teletext and mode 7 dump. ROMs reviewed. Hints & Tips. Beeb Forum. Add sounds to your games. Learn Lisp 1. Cube graphics. Printer driver for View. Basic II from Basic I. Beeb's ADC chip. Atom Forum. Listing formatter for the Atom. Atom 'bytes free' routine. Schools – test of *Factfile*. Keyboard skills. Amcom DFS v Acorn DFS. Reviews: *Beebpen* wordprocessor, Atom expansion system, software, books.

21. April Beeb graphics on TV. 6845 chip explored. Advanced filing systems. Lisp 2. Hints & Tips. Beeb Forum. Choose disc tracks to copy. Function key editing. Teletext dumps. CES scrutinised. Passing variables. Computer Concepts' graphics ROM. Schools – simulations. Calculating Easter dates. Better programming. Atom Forum. Atom ROM routines. Converting BBC to Atom Basic. Three printers compared. Reviews: software, Aries B20 RAM board, *Toolkit*, Monitors.

22. May Bitstik graphics system. Hints & Tips. 6502 second processor examined. Lisp 3. Beeb Forum. Disc utility to keep track of available space. Statistics. Pattern graphics. OSWORD explained. 4 colour graphics listings. Second-hand disc drives. Education – do girls get a fair deal? Atom Forum. BBC to Atom Basic 2. Reviews: British Micro's Grafpad, *Edword* wordprocessor, 4 sprite generators, Opus microdrive, Beasty, software.

23. June Acorn Z80 second processor. Forth. Graphics to brighten up your games. Soft Pottery graphics. Go faster and save memory space. Rapid search and load routine for tapes. How the Beeb and Electron work 1. Business: reviews and how to gently enter office computerisation. Education – adult literacy. Dumping Atom programs on the BBC. Atom Forum. Software copyright laws. Hints & Tips. Techniques – B-Trees. Beeb Forum. Reviews of monitors, printers, books, software, adventures, EPROM programmer.



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Four issues of Acorn User are not available – July 1982, February, March and April 1983. Copies of articles are available at 18p a page (minimum charge 50p, inclusive of postage). Orders should be addressed to Kate Evans, Redwood Publishing, 68 Long Acre, London WC2E 9JH.

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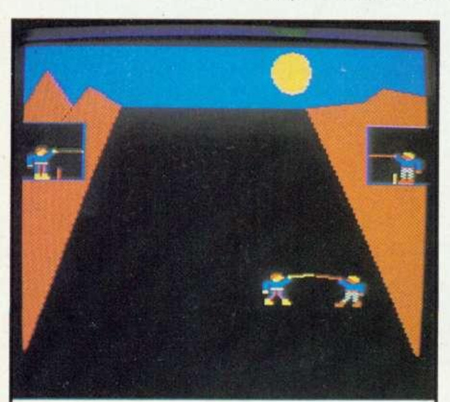
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SWORD MASTER is one of the few two-player games around, and is designed for joystick or keyboard.

Sword Master by Ken Worrall is based on the fencing rules written in 1190 by Herman von Salza for the Deutscritter Order of Teutonic Knights. It features full-colour machine code animation of a sword duel between the players shown on screen as knights.

Full instructions, music, sound effects, player rankings (from Greenhorn to Swordmaster) and a roll of honour (which can be saved) are all included. The game also closely reflects the rules, style and dress of the Deutscritter Order.



TREK was the first game to take advantage of voice synthesis on the BBC micro – and uses joystick or keyboard.

Trek puts you in charge of a Starship with the task of wiping out an alien fleet. It's an excellent adaptation of the classic game with 7 screen displays, 3 on-board computers and 2 weapon systems.

Versions have been written for BBC micro and Electron to use both machines to their full. The BBC tape uses voice synthesis (if the chips are fitted).

The game has been extensively developed from Tim Heaton's famous Trek III. It barely fits into 32k.

DISC UPGRADE SERVICE

Return your cassette of Trek or Swordmaster, and we will exchange it for a disc (which will run on 40 or 80-track drives) for just £3.50. Please specify Amcom, Watford or Acorn DFS.

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The tapes come with BBC programs on one side and Electron programs as the other, so it shouldn't be possible to mix the two.
Order form on page 95.



Save yourself the time and bother of typing in Acorn User listings

ORDER FORM ON PAGE 95

See 'High-Speed Random Numbers', page 106

Program 1. Subroutine used in Hi-Basic for producing a 32-bit pseudo-random number

```
 10 P%=&C00
 20 [OPT 2
 30
 40 .newRND
 50 LDY #4
 60
 70 .next_byte
 80 ROR &11
 90 LDA &10
100 PHA
110 ROR A
120 STA &11
130 LDA &0F
140 TAX
150 ASL A
160 ASL A
170 ASL A
180 ASL A
190 STA &10
200 LDA &0E
210 STA &0F
220 LSR A
230 LSR A
240 LSR A
250 LSR A
260 ORA &10
270 EOR &11
280 STX &10
290 LDX &0D
300 STX &0E
310 STA &0D
320 PLA
330 STA &11
340 DEY
350 BNE next_byte
360 RTS
370 ]
380
390 Y%=1
400 REPEAT
410   CALL next_byte
420   PRINT ?&0D
430   UNTIL 0
440 END
450
460 REM or for 4 bytes.
470 REM don't need Y%
480
490 REPEAT
500   CALL newRND
510   PRINT !&0D
520   UNTIL 0
530 END
```

Program 2. Control software for the two hardware RNGs, plus tests to check their randomness

```
 10 PROCinitialise
 20 MODE4
 30 REPEAT
 40   PROCmenu
 50   UNTIL end
 60 CALL int_off
 70 END
 80
 90 DEF PROCmenu
100 REM ********
110 CLS
120 PRINT"Analogue or digital? (0/1)"
130 INPUT "(or -1 to end.)" digital
140 IF digital<0 THEN end = 1 : ENDPROC
150 digital = -digital
160 analogue = NOT digital
170 PROCassemble_tests
180 INPUT"Histogram or map? (0 or 1)", map
190 IF analogue INPUT "Delay", delay%
200 IF analogue ?delaytime = delay%
210 IF digital CALL initialise_digital
220 IF analogue CALL initialise_analogue
230 IF map PROCdrawmap ELSE PROChistogram
240 ENDPROC
250
260 DEF PROCdrawmap
270 REM ***********
280 CLS
290 CALL RNDmap
300 ENDPROC
310
320 DEF PROChistogram
330 REM *************
340 INPUT"How many sets of values", A%
350 Q% = A%
360 FOR M% = 0 TO 255
370   N%(M%) = 0
380   NEXT
390 REPEAT
400   CALL RNDhistogram
410   max% = 0 : min% = &FFFF : tot% = 0
420   FOR M% = 0 TO 255
430     N%(M%) = N%(M%)+?(B%+M%)+?(C%+M%)*256
440     tot% = tot%+N%(M%)
450     IF N%(M%)>max% max% = N%(M%)
460     IF N%(M%)<min% min% = N%(M%)
470     NEXT
480   CLS
490   PRINT"max ";max%;"  min ";min%;
500   PRINT"  ave ";tot%/256;"  ";
510   R% = (max%-min%)/tot%*1280000
520   PRINT"  range +/- ";R%/100;"%  ";
530   FOR M% = 0 TO 255
540     PLOT69,M%*4,N%(M%)*3.8/Q%
550     NEXT
560   Q% = Q%+A%
570   UNTIL INKEY(0)>0
580 ENDPROC
590
600 DEF PROCerr_handle
610 REM **************
620 CALL int_off
630 REPORT
640 PRINT" at "ERL
```

Continued ▶

See 'High-Speed Random Numbers', page 106

◀ Continued

```
650 ENDPROC
660
670 DEF PROCinitialise
680 REM **************
690 DIM B% 256, C% 256, N%(255)
700 ON ERROR PROCerr_handle : END
710 oldIRQ = !&204 AND &FFFF
720 end = 0
730
740 REM Assemble RNG routines
750 REM *********************
760 FOR opt% = 0 TO 2 STEP 2
770   P% = &C00
780   [OPT opt%
790
800    .initialise_digital
810    \******************
820    LDA #&88  \ Shift in under system clock,
830    STA &FE6B \ and Timer 1 one-shot on PB7.
840
850    LDA #&81  \ Set PB0 + PB7 as outputs.
860    STA &FE62
870
880    LDA #18
890    STA &FE64 \ Set delay time on Timer 1.
900    LDA #0
910    STA &FE65
920
930    LDA &FE6A \ Dummy read of SR.
940
950    SEI
960    LDA #IRQ MOD 256 \ Interrupts
970    STA &204         \ are now
980    LDA #IRQ DIV 256 \ active.
990    STA &205
1000   CLI
1010   RTS
1020
1030   .IRQ
1040   \***
1050   LDA #1         \ Invert PB0 line.
1060   EOR &FE60
1070   STA &FE60
1080   JMP oldIRQ   \ Back to IRQ routines.
1090
1100   .digRND
1110   \******
1120   BIT &FE6D
1130   BVC digRND \ Timer 1 not timed out yet.
1140
1150   .digRNDnotWAIT \ Start here if > 20 uS
1160   LDX #0           \ since last access.
1170   STX &FE65 \ Start timer 1.
1180             \ = switch to CB2 clock.
1190   LDA &FE6A \ Read shift register.
1200   RTS
1210
1220   .int_off
1230   \*******
1240   SEI
1250   LDA #oldIRQ MOD 256
1260   STA &204      \ Restore original
1270   LDA #oldIRQ DIV 256
1280   STA &205      \ value of IRQ1V.
1290   CLI
1300   RTS
1310
1320   .initialise_analogue
1330   \*******************
1340   LDA #&04      \ shift in under control
1350   STA &FE6B     \ of Timer 2.
1360
1370   LDA delaytime
1380   STA &FE68     \ Set up value
1390   LDA #0        \ of Timer 2.
1400   STA &FE69
1410
1420   LDA &FE6A     \ Dummy read of SR.
1430   RTS
1440
1450   .delaytime
1460   NOP          \ Save one byte of space.
1470
1480   .anaRND
1490   \******
1500   LDA #4
1510   .ready
1520   BIT &FE6D  \ Has new value
1530   BEQ ready  \ shifted in yet?
1540
1550   LDA &FE6A  \ Read shift register.
1560   RTS
1570   ]
1580   NEXT
1590 tests% = P%
1600 ENDPROC
1610
1620 DEF PROCassemble_tests
1630 REM ******************
1640 rndGEN = anaRND
1650 IF digital rndGEN = digRND
1660 FOR opt% = 0 TO 2 STEP 2
1670   P% = tests%
1680   [OPT opt%
1690
1700   .RNDmap
1710   \******
1720   LDA #25
1730   JSR &FFEE    \ PLOT,
1740
1750   LDA #69
1760   JSR &FFEE    \ a single dot,
1770
1780   JSR rndGEN   \ at, X low,
1790   JSR &FFEE
1800
1810   JSR rndGEN   \ X high,
1820   AND #3
1830   JSR &FFEE
1840
1850   JSR rndGEN   \ Y low,
1860   JSR &FFEE
1870
1880   JSR rndGEN   \ Y high.
1890   AND #3
1900   JSR &FFEE
1910
1920   LDA #&81     \ Has a key
1930   LDX #0       \ been pressed?
1940   LDY #0
1950   JSR &FFF4
1960   BCS RNDmap
1970   RTS
1980
1990   .RNDhistogram
2000   \************
2010   LDA #0
2020   TAX
2030   .wipe
2040   STA B%,X    \ Write zeros into
2050   STA C%,X    \ results table.
2060   INX
2070   BNE wipe
2080
2090   .sample
2100   JSR rndGEN \ Get a random
2110   TAX        \ number in X register.
2120   INC B%,X   \ Increment the counter.
2130   BNE sample
2140   INC C%,X   \ Increment the next byte.
2150   LDA &404   \ A% = number of sets.
2160   CMP C%,X   \ Enough yet?
2170   BNE sample \ If not, get another.
2180   RTS
2190   ]
2200   NEXT
2210 ENDPROC
```

See pages 33 and 35

Tessie Revivis' 'Fly in the Sky' program demonstrates use of elementary animation and sound

```
>PLEASE LIST THE PROGRAM
   10 REM *** (c) Acorn User  Sept.84 ***
   20 dead_flag=1
   30 MODE 0
   40 VDU 23,1,0;0;0;0;
   50 REPEAT
   60   start=0 : finish=79 : step=1
   70   PROCfly
   80   IF dead_flag=0 THEN END
   90   start=79: finish=0 : step=-1
  100   PROCfly
  110   IF dead_flag=0 THEN END
  120   UNTIL 0
  130 :
  140  *** procedures here ***
  150 :
  160 DEF PROCfly
  170 FOR pos=start TO finish STEP step
  180   PRINTTAB(pos,3);"*";
  190   SOUND0,-15,2,1
  200   key$=INKEY$(0)
  210   IF key$=" " THEN PROCdie (pos)
  220   FOR delay=0 TO 50 : NEXT
  230   PRINTTAB(pos,3);" ";
  240   IF dead_flag=1 NEXT
  250 ENDPROC
  260 :
  270 :
  280 DEF PROCdie (pos)
  290 P=pos:pos=finish:NEXT
  300 dead_flag=0
  310 *FX21,4
  320 PRINTTAB(P,3);" ";
  330 FOR down=3 TO 32
  340   SOUND0,-15,3,1
  350   PRINT TAB(P,down);"*";
  360   FOR delay=0 TO 50 : NEXT
  370   PRINT TAB(P,down);" ";
  380   NEXT
  390 *FX21,4
  400 SOUND0,-15,6,10
  410 ENDPROC
```

The procedures behind Michael Why's 'Paranoids', explained step by step in his article

```
>
   10 REM ******************************
   20 REM ***  PARAS by Michael Why  ***
   30 REM *** (c) Acorn User Sept.84 ***
   40 REM ******************************
   50 DIM PARAY%(30),PARAX%(30),X%(30),Y
%(30),PARA$(30)
   60 PROCINIT
   70 MODE2
   80 MODE4:VDU23;8202;0;0;0;
   90 REPEAT
  100 REPEAT
  110 PROCTANK
  120 PROCTANK
  130 PROCPARAS
  140 PROCTANK
  150 UNTIL HIT%+1=PARA% OR LIFE%=1
  160 PROCLEVEL
  170 UNTIL LIVES%=3
  180 MODE6
  190 END
  200 :
  210 DEFPROCINIT
  220 Z=0:PARA%=4:HIT%=0:LAND%=0:SCORE%=
0:LIFE%=0:LIVES%=0:LEVEL%=1
  230 VDU23,224,155,155,195,60,24,24,36,
195,23,225,60,126,255,255,129,66,36,0
  240 FORL%=1TOPARA%:PARA$(L%)=CHR$225+C
HR$10+CHR$8+CHR$224:NEXT
  250 VDU23,226,1,1,7,63,127,161,115,33,
23,227,128,128,224,252,254,133,206,132
  260 VDU23,228,231,36,60,66,153,153,66,
36,23,229,36,66,153,153,66,60,36,231
  270 SPACE$=CHR$32+CHR$10+CHR$8+CHR$32
  280 explode$=CHR$228+CHR$10+CHR$8+CHR$
229
  290 tank$=CHR$226+CHR$227
  300 VDU23,1,0;0;0;0;
  310 FORL%=1TOPARA%:X%(L%)=RND(3)-2:Y%(
L%)=1:NEXT
  320 T%=20
  330 FIRE%=0:FORL%=1TOPARA%:PARAX%(L%)=
RND(27)+5:PARAY%(L%)=2:NEXT
  340 IFPARAX%(L%)=PARAX%(L%-1)THENPARAX
%(L%)=PARAX%(L%)-1
  350 ENDPROC
  360 :
  370 DEFPROCTANK
  380 IFINKEY(-85)THENREPEATUNTILINKEY(-
67)
  390 IFSCORE%<0THENSCORE%=0
  400 PRINTTAB(8,1);"      "
  410 PRINTTAB(2,1);"SCORE=";SCORE%;TAB(
14,1);"LIVES LOST=";LIVES%;TAB(29,1);"LE
VEL=";LEVEL%
  420 PRINTTAB(T%,29);"   "
  430 *FX15,1
  440 IFINKEY(-67)ANDT%<=35
THENT%=T%+1:Z =1
  450 IFINKEY(-98)ANDT%>=5
THENT%=T%-1:Z= 1
  460 PRINTTAB(T%,29);tank$
  470 IFZ=0THENENDPROC
  480 Z=0
  490 ENDPROC
  500 :
  510 DEFPROCPARAS
  520 VDU20
  530 VDU19,1,3,0,0,0
  540 L%=1
  550 IFPARA$(L%)=SPACE$THEN630
  560 COLOUR1
  570 IFPARAY%(L%)>=27THENPRINTTAB(PARAX
%(L%),PARAY%(L%));SPACE$:PARAY%(L%)=2:PA
RAX%(L%)=PARAX%(L%):LAND%=LAND%+1:SCORE%
=SCORE%-100:IFLAND%>=1THENPROCNEW_LIFE
  580 IFPARAX%(L%)>=35THENPRINTTAB(PARAX
%(L%),PARAY%(L%));SPACE$:PARAX%(L%)=3

  590 IFPARAX%(L%)<=2THENPRINTTAB(PARAX%
(L%),PARAY%(L%));SPACE$:PARAX%(L%)=35
  600 PRINTTAB(PARAX%(L%),PARAY%(L%));SP
ACE$
  610 PARAX%(L%)=PARAX%(L%)+X%(L%):PARAY
%(L%)=PARAY%(L%)+Y%(L%)
  620 PRINTTAB(PARAX%(L%),PARAY%(L%));PA
RA$(L%)
  630 PROCFIRE
  640 IFL%<>PARA%THENL%=L%+1
  650 IFL%<>PARA%THENGOTO550ELSEGOTO660
```

Continued ▶

See pages 37 and 45

◄ *Continued*

```
  660 ENDPROC
  670 :
  680 DEFPROCFIRE
  690 FIREX%=T%
  700 IFNOTINKEY(-99)THENENDPROC
  710 ENVELOPE2,1,-12,-6,-3,3,6,12,126,0
,0,-126,126,126
  720 SOUND&11,2,200,4
  730 tank_base%=32*T%+32
  740 MOVEtank_base%,90
  750 DRAWtank_base%,32*(31)
  760 PLOT7,tank_base%,90
  770 FIRE%=0
  780 IFPARAX%(L%)=FIREX%ORPARAX%(L%)-1=
FIREX%THENPROCXPLODE
  790 ENDPROC
  800 :
  810 DEFPROCXPLODE
  820 SCORE%=SCORE%+50
  830 PRINTTAB(PARAX%(L%),PARAY%(L%));SP
ACE$
  840 ENVELOPE2,2,-12,0,-3,3,6,12,126,0,
0,-126,126,126
  850 SOUND&11,2,255,12
  860 PRINTTAB(PARAX%(L%),PARAY%(L%));ex
plode$
  870 TIME=0:REPEATUNTILTIME>25
  880 PRINTTAB(PARAX%(L%),PARAY%(L%));SP
ACE$
  890 PARA$(L%)=SPACE$
  900 PARAX%(L%)=3:PARAY%(L%)=2:X%(L%)=0
:Y%(L%)=0:HIT%=HIT%+1
  910 ENDPROC
  920 :
  930 DEFPROCLEVEL
  940 IFLIVES%=3THENPROCGAME_LOST
  950 LEVEL%=LEVEL%+1
  960 IFLAND%=0THENSCORE%=SCORE%+50
  970 PARA%=PARA%+1
  980 FORL%=1TOPARA%:PARAX%(L%)=RND(27)+
5:PARAY%(L%)=2:X%(L%)=RND(3)-2:Y%(L%)=1:
NEXT
  990 HIT%=0
 1000 FORL%=1TOPARA%:PARA$(L%)=CHR$225+C
HR$10+CHR$8+CHR$224:NEXT
 1010 ENDPROC
 1020 :
 1030 DEFPROCNEW_LIFE
 1040 LIFE%=LIFE%+1
 1050 LIVES%=LIVES%+LIFE%
 1060 IFLIFE%=1THENPROCTANK_LOST
 1070 IFLIVES%=3THENPROCGAME_LOST
 1080 LAND%=0
 1090 LIFE%=0
 1100 ENDPROC
 1110 :
 1120 DEFPROCTANK_LOST
 1130 LAND%=0:A%=0
 1140 CLS
 1150 PRINTTAB(14,15);"LIFE LOST":SOUND1
,-15,150,5
 1160 TIME=0:REPEATUNTILTIME=100
 1170 CLS
 1180 IFLIVES%=3THENPROCGAME_LOST
 1190 ENDPROC
 1200 :
 1210 DEFPROCGAME_LOST
 1220 IFSCORE%<0THENSCORE%=0
 1230 PRINTTAB(14,8);"YOUR SCORE=";SCORE
%
 1240 PRINTTAB(4,12);"PRESS SPACE TO STA
RT OR E TO END"
 1250 REPEAT
 1260 IFINKEY(-99)THENRUN
 1270 IFINKEY(-35)THENCLS:END
 1280 UNTILINKEY(-99)ORINKEY(-35)
 1290 ENDPROC
 1300 :
 1310 DEFPROCDELAY:TIME=0:REPEATUNTILTIM
E=17:ENDPROC
```

See pages 48, 50 and 52

Listing 1.

```
   10 REM Listing 1
   20 REM Run this program before using function keys
   30 *KEY0
L$="L."+STR$L%+","+STR$(L%+9)+CHR$12+CHR$13:A%=138:X%=0:FOR Z%=1 TO
LEN L$:Y%=ASC(MID$(L$,Z%)):CA.&FFF4:N.:L%=L%+10:|M
   40 *KEY1 IN."List from",L%|L|M
```

Listing 2.

```
10 REM Listing 2
20 A$=""
30 FOR N%=1 TO 10
40 REPEAT:B$=STR$(RND(10)-1)
50 UNTIL INSTR(A$,B$)=0
60 A$=A$+B$+" "
70 NEXT N%
80 PRINT A$
```

Listing 3

```
 10 REM Listing 3
 20 MODE7
 30 DIM X(10)
 40 A=1
 50 REPEAT
 60 T=RND(10):Q=1
 70 IFX(Q)=T THEN 60
 80 Q=Q+1
 90 IF Q<10 THEN 70
100 X(A)=T:A=A+1
110 UNTIL A>10
120 FOR P=1 TO 10
130 PRINT X(P)
140 NEXT
```

Listing 4

```
 10 REM Listing 4
 20 TIME = 0
 30 FOR T=1 TO 100
 40 A$=""
 50 FOR N%=1 TO 10
 60 REPEAT:B$=STR$(RND(10)-1)
 70 UNTIL INSTR(A$,B$)=0
 80 A$=A$+B$+" "
 90 NEXT N%
100 PRINT A$
110 NEXT T
120 PRINT "Time = ";TIME/100;"
    centiseconds"
```

Listing 5

```
 10 REM Listing 5
 20 A$=""
 30 FOR N%=1 TO 13
 40 REPEAT:B$=STR$(RND(13))
 50 IF B$="10" THEN B$="J"
 60 IF B$="11" THEN B$="Q"
 70 IF B$="12" THEN B$="K"
 80 UNTIL INSTR(A$,B$+" ")=0
 90 A$=A$+B$+" "
100 NEXT N%
110 PRINT A$
```

Listing 6

```
 10 REM Listing 6
 20 A$=""
 30 DIM suit$(4)
 40 suit$(1)="H":suit$(2)="C"
 50 suit$(3)="D":suit$(4)="S"
 60 FOR N%=1 TO 52
 70 REPEAT
 80 C$=suit$(RND(4))
 90 B$=STR$(RND(13))
100 IF B$="11" THEN B$="J"
110 IF B$="12" THEN B$="Q"
120 IF B$="13" THEN B$="K"
130 B$=C$+"-"+B$
140 UNTIL INSTR(A$,B$+" ")=0
150 A$=A$+B$+" "
160 NEXT N%
170 PRINT A$
```

Listing 7

```
10 REM Listing 7
20 A=3.2
30 B=6.4
40 C=9.6
50 IF A+B=C PRINT"Correct"
60 PRINT"I've finished"
```

Listing 8

```
10 REM Listing 8
20 A=3
30 B=6.4
40 C=9.4
50 IF A+B=C PRINT"Correct"
60 PRINT"I've finished"
```

See pages 48, 50 and 52

Listing 9

```
 10 REM Listing 9
 20 A=3
 30 B=6.4
 40 C=9.4
 50 IF A+B=C PRINT"Correct"
 60 PRINT "A = ";A
 70 PRINT "B = ";B
 80 PRINT "C = ";C
```

Listing 10

```
 10 REM Listing 10
 20 @%=&20200
 30 amount%=0
 40 PRINT"Press 0 to end"
 50 REPEAT
 60 INPUT"Amount in pounds and pence
    £"amount
 70 amount%=amount%+amount*100
 80 UNTIL amount=0
 90 INPUT"Enter total £"total
100 total%=total*100
110 IF amount%=total% PRINT
    "Figures agree"
120 PRINT"£"amount%/100"
    £"total%/100
```

Listing 11

```
 10 REM Listing 11
 20 @%=0
 30 tot=0
 40 PRINT"Press 0 to end"
 50 REPEAT
 60 INPUT"Amount in pounds and pence
    £"amount
 70 tot=tot+amount
 80 UNTIL amount=0
 90 INPUT"Enter total £"total
100 IF ABS(tot-total)<0.001 PRINT
    "Figures agree"
110 PRINT"£"tot"      £"total
```

Listing 12

```
10 REM Listing 12
20 *KEY10 OLD|M *TAPE|M RUN|M
30 ON ERROR GOTO 60
40 *OPT2,1
50 PRINT "Tape system"
60 IF ERL=40 THEN PRINT "Disc system"
70 ON ERROR OFF
```

Listing 13

```
10 REM Listing 13
20 VDU2,1,32,1,32,3
30 IF ADVAL(-4)=63 THEN PRINT"PRINTER
   CONNECTED"
```

Listing 14

```
 10 REM Listing 14
 20 REM Fast circle drawing
 30 REM Electron 3.99sec, BBC 1.28sec
 40 TIME=0
 50 MODE1
 60 VDU29,640;512;
 70 R%=400
 80 c=COS(PI/30):s=SIN(PI/30)
 90 oc=1:os=0
100 MOVE R%*oc,R%*os
110 FOR A%=1 TO 60
120 nc=oc*c-os*s
130 ns=os*c+oc*s
140 DRAW R%*nc,R%*ns
150 oc=nc:os=ns
160 NEXT
170 PRINTTIME/100;"sec"
```

Listing 15

```
 10 REM Listing 15
 20 REM Fast circle drawing
 30 REM Electron 1.59sec, BBC 0.49sec
 40 MODE1
 50 PROCsetup
 60 TIME=0
 70 PROCcircle
 80 PRINT TIME/100;"sec"
 90 END
100 :
110 DEFPROCsetup
120 VDU29,640;512;
130 R%=400
140 DIM cos(60),sin(60)
150 FOR A%=1 TO 60
160 cos(A%)=COS(A%*PI/30)
170 sin(A%)=SIN(A%*PI/30)
180 NEXT
190 ENDPROC
200 :
210 DEFPROCcircle
220 MOVE R%,0
230 FOR A%=1 TO 60
240 DRAW R%*cos(A%),R%*sin(A%)
250 NEXT
260 ENDPROC
```

KALEIDOSCOPE

REMEMBER those cardboard tubes containing coloured chips which reflected in a mirror system to produce random but regular patterns? No, nor do we. But they were popular Victorian toys and enjoyed a revival some years ago. Now Christopher Johnston puts the same effects onto the screen with this *Kaleidoscope* program. *Kaleidoscope* provides up to 16 different rotating swirls of colour for BBC Model B and Electron owners.

After entering the program run it and input a number from 1 to 16 as requested. The kaleidoscope base will generate before your very eyes by plotting eight squares of the same colour symmetrically about the mode 2 screen. The screen takes about three minutes to fill before its contents begin to rotate and flash in an ever-changing pattern.

The < and > keys can be used to speed up the direction of rotation either left or right and pressing the space bar freezes the display for closer inspection. The RETURN key allows you to set all colours to black if the program dazzles you with its brilliance!

```
   10 REM ***      KALEIDOSCOPE   ***
   20 REM ***    by C.Johnston    ***
   30 REM *** (c) Acorn User      ***
   40 MODE6
   50 PROCinit
   60 MODE2
   70 PROCpattern
   80 REPEAT
   90 K%=INKEY(0)
  100 IF K%>0 THEN PROCkey
  110 IF D%>5 THEN PROCforward ELSE PROC
reverse
  120 UNTIL FALSE
  130 DEFPROCinit
  140 DIM C%(15),D%(10)
  150 FOR D%=0 TO 10
  160 D%(D%)=100-(D%-5)*(D%-5)*4
  170 NEXT
  180 N%=-1
  190 REPEAT
  200 N%=N%+1
  210 READ F$
  220 UNTIL F$=""
  230 REPEAT
  240 PRINT"WHICH PATTERN (1-";N%;") ";
  250 INPUT F%
  260 UNTIL F%>=1 AND F%<=N%
  270 RESTORE
  280 FOR L%=1 TO F%
  290 READ F$
  300 NEXT
  310 DATA 6E6 DIV ((X%-604)*(Y%-60)*(X%
-Y%-100))
  320 DATA 5E7 DIV ((X%-204)*(Y%-300)*(X
%-Y%-300))
  330 DATA 5E4 DIV ((Y%-60)*(Y%-X%+204))
  340 DATA 1.2E5 DIV ((Y%+1)*(Y%-X%-1))
  350 DATA 1E6 DIV ((Y%+1)*(Y%-X%-1))
  360 DATA 1E5 DIV ((X%-404)*(Y%-150))
  370 DATA 3E8 DIV ((X%+500)*(Y%+500))
  380 DATA 100*(Y%+8) DIV (X%+8)
  390 DATA 1000*(Y%+8) DIV (X%+8)
  400 DATA 1200*(X%+350) DIV (Y%+500)
  410 DATA X%*(Y%+1) DIV 40
  420 DATA X%*(Y%+1) DIV 80
  430 DATA X%*(Y%+1) DIV 200
  440 DATA X%*(Y%+5) DIV 1000
  450 DATA (X%*X%+Y%*Y%) DIV 1000
  460 DATA (X%*X%*X%+Y%*Y%*Y%) DIV 1E5
  470 DATA ""
  480 *FX9,50
  490 *FX10,50
  500 D%=10
  510 ENDPROC
  520 DEFPROCpattern
  530 VDU23,1,0;0;0;0;
  540 VDU29,640;512;
  550 FOR Y%=0 TO 512 STEP 8
  560 FOR R%=1 TO 3
  570 VDU19,RND(15),RND AND 15;0;
  580 NEXT
  590 FOR X%=Y% TO 640 STEP 8
  600 GCOL0,EVAL(F$) AND 15
  610 FOR A%=-1 TO 1 STEP 2
  620 FOR B%=-1 TO 1 STEP 2
  630 PLOT69,X%*A%,Y%*B%
  640 PLOT65,0,4
  650 PLOT69,Y%*B%,X%*A%
  660 PLOT65,0,4
  670 NEXT
  680 NEXT
  690 NEXT
  700 NEXT
  710 ENDPROC
  720 DEFPROCkey
  730 REPEAT
  740 IF (K%=46 OR K%=62) AND D%<10 THEN
 D%=D%+1
  750 IF (K%=44 OR K%=60) AND D%>0 THEN
D%=D%-1
  760 IF K%=32 THEN D%=5
  770 IF K%=13 THEN PROCblack
  780 K%=INKEY(0)
  790 UNTIL D%<>5
  800 *FX15,1
  810 ENDPROC
  820 DEFPROCforward
  830 P%=FNrnd(0)
  840 FOR L%=0 TO 15
  850 FOR W%=1 TO D%(D%)
  860 NEXT
  870 VDU19,L%,P%;0;
  880 C%=C%(L%)
  890 C%(L%)=P%
  900 P%=C%
  910 NEXT
  920 ENDPROC
  930 DEFPROCreverse
  940 P%=FNrnd(15)
  950 FOR L%=15 TO 0 STEP-1
  960 FOR W%=1 TO D%(D%)
  970 NEXT
  980 VDU19,L%,P%;0;
  990 C%=C%(L%)
 1000 C%(L%)=P%
 1010 P%=C%
 1020 NEXT
 1030 ENDPROC
 1040 DEFFNrnd(C%)
 1050 R%=(RND AND 3)*(RND AND 1)
 1060 IF R%=3 THEN R%=4
 1070 =C%(C%) EOR R%
 1080 DEFPROCblack
 1090 FOR L%=0 TO 15
 1100 FOR W%=1 TO 200
 1110 NEXT
 1120 VDU19,L%,0;0;
 1130 C%(L%)=0
 1140 NEXT
 1150 FOR W%=1 TO 2000
 1160 NEXT
 1170 ENDPROC
```

VII

See 'Spritely Characters', pages 74–79

Harry Sinclair's sprite generator program, 'Design'. Turn to page x for instructions on entering it and converting for the Electron

```
    1 REM ******************************
    2 REM *** (c) Acorn User Sept.1984
    3 REM *** DESIGN by Harry Sinclair
    4 REM ******************************
    5 REM ** IMPORTANT: Set PAGE=&1900
    6 REM ******************************
   10 *KEY10?&224=&A6|MPA.=&1900|MOLD|M
   20 *TV255
   30 ONERROR PROCwind_up:END
   40 MODE7
   50 FORI%=0TO1:PRINTTAB(7,3+I%)CHR$129
+CHR$157+CHR$141+CHR$135"SPRITE DESIGN"+
CHR$9+CHR$9+CHR$9+CHR$156:NEXT
   60 PRINTTAB(0,7)" You may design char
acters with a width of between 8 and 20
pixels - only even  numbers are allowed"
''"Please enter width :"
   70 REPEATPRINTTAB(20,11)SPC(26);:INPU
TTAB(20,11)" "W%:UNTILW%>7ANDW%<21 AND N
OTW%MOD2
   80 W%=W%/2:IFW%=4 RESTORE110 ELSEIFW%
=5 RESTORE120 ELSE RESTORE130
   90 FORI%=&12F0 TO&12FF STEP 2:READA$:
!I%=EVAL("&"+A$):NEXT
  100 ?&12EF=W%*8
  110 DATA1300,1360,1300,1400,1460,1500,
1460,1560
  120 DATA1300,1378,1300,1400,1478,1500,
1478,1578
  130 DATA1300,1400,1300,1500,1600,1700,
1600,1800
  140 cha%=0:table%=&12F0:end%=FALSE
  150 *FX4,1
  160 MODE2:VDU23,1,0;0;0;0;
  170 VDU23,240,0,0,&F0,&F0,&F0,&F0,0,0,
23,241,0,0,&40,&E0,&40,0,0,0
  180 FORI%=0TO&5FF STEP4:I%!&1300=0:NEX
T
  190 PROCassemble
  200 key$="0123456789ABCDEF"
  210 REPEAT
  220 I%=cha%*2:base%=I%?&12F0+I%?&12F1*
256+8
  230 space%=(80-?&12EF DIV8*7)DIV8
  240 CLG:IF cha%<>0:?&71=space%:FORI%=0
TO cha%-1:?&70=I%:?&72=16:CALL display:?
&71=?&71+W%/2+space%:NEXT
  250 VDU28,0,22,7,9,4
  260 VDU30:COLOUR7:PRINT"KEYS"
  270 @%=0:PRINTTAB(0,2)"0";TAB(2);"8";:
COLOUR8:PRINTCHR$240:FORI%=1TO7:COLOURI%
:PRINTI%;CHR$240;~I%+8;:COLOURI%+8:PRINT
CHR$240:COLOURI%-1:NEXT
  280 VDU28,0,31,19,21
  290 COLOUR6:PRINTTAB(2,0)"Press TAB wh
en"'';TAB(2)"design finished":COLOUR3
  300 PRINT'TAB(1)"Use cursor keys to"''
"  position pointer"
  310 W%=?&12EF/4:VDU29,440-8*(W%-8)-8;4
00;:MOVE0,0
  320 PLOT21,0,12*32+6:PLOT29,W%*32+8,12
*32+6:PLOT21,W%*32+8,0:PLOT29,0,0
  330 GCOL0,7
  340 X%=8:Y%=24
  350 PROCpntr(X%,Y%)
  360 REPEAT
  370 K%=INSTR(key$,GET$)
  380 IF K%<>0 col%=K%-1:PROCdraw(col%,X
%,Y%):PROCpntr(X%,Y%)
  390 IFINKEY(-58)ANDY%<384 PROCpntr(X%,
Y%):Y%=Y%+16:PROCpntr(X%,Y%)
  400 IFINKEY(-42)ANDY%>24 PROCpntr(X%,Y
%):Y%=Y%-16:PROCpntr(X%,Y%)
  410 IFINKEY(-26)ANDX%>8 PROCpntr(X%,Y%
):X%=X%-32:PROCpntr(X%,Y%)
  420 IFINKEY(-122)ANDX%<32*(W%-1) PROCp
ntr(X%,Y%):X%=X%+32:PROCpntr(X%,Y%)
  430 UNTILINKEY(-97)
  440 cha%=cha%+1:IFcha%=2 cha%=3 ELSE I
Fcha%=6 cha%=7
  450 VDU4,12,23,1,0;0;0;0;
  460 IF cha%=8 PRINTTAB(2,0)"8 chars. d
efined.";TAB(4,2)"No more room.";TAB(2,7
);:COLOUR3:PRINT"SPACE to continue":end%
=TRUE:ELSE PRINTTAB(7,2)"press";TAB(1,4)
;:COLOUR3:PRINT" SPACE to continue";TAB(
2,6);:COLOUR6:PRINT"  CTRL Z to exit "
  470 REPEATG=GET:UNTILG=&20 ORG=&1A:IFG
=&1A end%=TRUE
  480 UNTIL end%
  490 *FX4
  500 MODE7
  510 @%=4
  520 PRINTTAB(0,2)" Data goes from"CHR$
134"&1300"CHR$135"to"CHR$134;"&";~base%+
3*?&12EF:PRINT'';CHR$131;cha%;CHR$135;"c
haracters defined"CHR$131;"(0 to ";cha%-
1;")."
  530 PRINT''" Table of addresses is @";
CHR$130;"&12F0";CHR$135;"to";CHR$130;"&"
;~&12F0+cha%*2-1
  540 PRINT''" Do you want to save the d
ata and the "'" address table (Y/N)?";:R
EPEATG=GET OR&20:UNTILG=&79 OR G=&6E
  550 IFG=&79 PROCsave
  560 PRINT'TAB(14)"Bye Bye"
  570 END
  575 :
  580 DEFPROCpntr(X%,Y%)
  590 VDU5
  600 MOVEX%,Y%
  610 GCOL3,7
  620 PRINTCHR$241
  630 ENDPROC
  640 DEFPROCdraw(col%,X%,Y%)
  650 VDU5
  660 MOVEX%,Y%
  670 ?&88=(X%-6)DIV32:?&89=23-((Y%-24)D
IV16):?&87=col%:address?1=base%MOD256:ad
dress?2=base%DIV256:store?3=base%MOD256:
store?4=base%DIV256
  680 !&70=&4F78+(?&12EF*2)
  690 GCOL0,col%
  700 PRINTCHR$240
  710 CALL byte_number
  720 ENDPROC
  725 :
  730 DEFPROCwind_up
  740 *FX4
  750 VDU4:COLOUR7
  760 PRINT"ERROR ";ERR;" @ LINE ";ERL;:
REPORT:PRINT
  770 ENDPROC
  775 :
  780 DEFPROCsave
  790 PRINT''" What do you want to call
the file?"'CHR$136;"(max. 7 letters - no
 quotes needed)"
  800 REPEAT:PRINTTAB(14,16)SPC(20):INPU
TTAB(14,16)" "data$:UNTILLENdata$<=7
  810 FORI%=&3000 TO&3030:?I%=0:NEXT
  820 D%=&3000
  830 $(D%+&20)=data$:?D%=&20:D%?1=&30
  840 D%?2=&EE:D%?3=&12
  850 D%?&A=&EE:D%?&B=&12
  860 D%?&E=(base%+(3*?&12EF)+1)MOD256
  870 D%?&F=(base%+(3*?&12EF)+1)DIV256
  880 A%=0:X%=0:Y%=&30
  890 PRINT" Press RETURN when you're re
ady."'
```

Continued ▶

See 'Spritely Characters', pages 74–79


```
 900 REPEATUNTILGET=13
 910 CALL&FFDD
 920 PRINT'" Data saved
     as "data$
 930 ENDPROC
 935 :
 940 DEFPROCassemble
 950 FORI%=0TO2 STEP2
 960 P%=&1100
 965 REM Square bracket
     printed as left
     arrow in Mode7
 970 [OPTI%
 980 .byte_number
 990 LDA&89
1000 AND#7
1010 STA&8F
1020 LDA&89
1030 AND#&F8
1040 LSRA:LSRA:LSRA
1050 TAY
1060 LDX#0
1070 DEY
1080 BMI no_add
1090 LDA&12EF
1100 INX
1110 DEY
1120 BMI no_add
1130 INX
1140 CLC
1150 ADC&12EF
1160 .no_add
1170 CLC
1180 ADC&8F
1190 STA&8F
1200 LDA&88
1210 AND#&FE
1220 ASLA
1230 ASLA
1240 CLC
1250 ADC&8F
1260 STA&8F
1270 STA&8D
1280 JSR pixad
1290 .byte_value
1300 LDX&8F
1310 .address
1315 \ dummy address
1320 LDA &8000,X
1330 STA&86
1340 LDA#0
1350 STA&85
1360 LDY#4
1370 CLC
1380 LDA&88
1390 LSRA
1400 BCC even
1410 CLC
1420 .odd
1430 ROR&86
1440 ROR&87
1450 ROR&85
1460 ROR&86
1470 ROR&85
1480 DEY
1490 BNE odd
1500 JMP store
1510 .even
1520 ROR&86
1530 ROR&85
1540 ROR&86
1550 ROR&87
1560 ROR&85
1570 DEY
1580 BNE even
1590 .store
1600 LDA&85
1605 \ dummy address
1610 STA &8000,X
1620 LDA#0
1630 STA&86
1640 STA&87
1650 LDY&8D
1660 LDA&85
1670 STA(&70),Y
1680 RTS
1690 .pixad
1700 DEX
1710 BMI end
1720 LDA&70
1730 CLC
1740 ADC#&80
1750 STA&70
1760 LDA&71
1770 ADC#2
1780 STA&71
1790 LDA&8D
1800 SEC
1810 SBC&12EF
1820 STA&8D
1830 JMP pixad
1840 .end
1850 RTS
1860 .display
1870 LDA#0
1880 STA&81
1890 LDA#&30
1900 STA&83
1910 LDA&71
1920 ASLA
1930 ROL&81
1940 ASLA
1950 ROL&81
1960 ASLA
1970 ROL&81
1980 STA&82
1990 LDA&81
2000 CLC
2010 ADC&83
2020 STA&83
2030 LDA&72
2040 AND#7
2050 EOR&72
2060 LSRA
2070 STA&81
2080 LSRA
2090 LSRA
2100 ADC&81
2110 LSRA
2120 STA&81
2130 LDA#0
2140 RORA
2150 CLC
2160 ADC&82
2170 STA&80
2180 LDA&81
2190 ADC&83
2200 STA&81
2210 LDA#&80
2220 CLC
2230 ADC&80
2240 STA&82
2250 LDA#2
2260 ADC&81
2270 STA&83
2280 LDA#&80
2290 CLC
2300 ADC&82
2310 STA&84
2320 LDA#2
2330 ADC&83
2340 STA&85
2350 LDA#&80
2360 CLC
2370 ADC&84
2380 STA&86
2390 LDA#2
2400 ADC&85
2410 STA&87
2420 LDA&70
2430 ASLA
2440 TAY
2450 LDA&12F0,Y
2460 CLC
2470 ADC#8
2480 LDX#0
2490 STA&88,X
2500 CLC
2510 .loop2
2520 ADC&12EF
2530 INX
2540 INX
2550 CPX#8
2560 BCS over
2570 STA&88,X
2580 BCC loop2
2590 .over
2600 CLC
2610 INY
2620 LDA&12F0,Y
2630 LDX#0
2640 .loop3
2650 STA&89,X
2660 INX
2670 INX
2680 CPX#8
2690 BCC loop3
2700 LDY&12EF
2705 \ draws character
2710 .mainloop
2720 TYA
2730 BEQ out
2740 DEY
2750 LDA(&88),Y
2760 BEQ block2
2770 STA(&80),Y
2780 .block2
2790 LDA(&8A),Y
2800 BEQ block3
2810 STA(&82),Y
2820 .block3
2830 LDA(&8C),Y
2840 BEQ loopend
2850 STA(&84),Y
2860 .loopend
2870 JMP mainloop
2880 .out
2890 RTS
2900 ]
2910 NEXT
2920 ENDPROC
```

Instructions ►

See 'Spritely Characters', pages 74–79

X

RUNNING DESIGN

THE 'Design' listing is one of the longest programs we've presented in *Acorn User*. To enable you to enter the program from the keyboard we have devised tests that we hope will reduce the number of typing errors you make in entering it, so that you can get it running with the minimum of effort.

The program can be broken down into two sections, Basic and assembly language. If you have never programmed in assembler before don't worry – a knowledge of its workings is not necessary for just typing it in exactly as you see it. But before starting ensure that PAGE has been set to &1900, whether you have tape or disc. To do this type:

```
PAGE = &1900 <return>
NEW <return>
```

From a debugging point of view you will find it a lot easier to enter the assembler listing first. This comprises lines 940 to 2920 inclusive. Long assembler listings tend to repeat themselves so it is easy to enter the wrong commands. To avoid this, use a small rule, preferably not transparent, to mark the line you are currently entering and move it down line by line. It saves time if you program the function keys with the most frequently used commands. Just write each key's pre-programmed command on a strip of paper and place it under the plastic strip above the function keys. We suggest this combination:

```
*KEY0 LDA
*KEY1 STA
*KEY2 INX
*KEY3 DEY
*KEY4 CLC
*KEY5 ROR
*KEY6 ROL
*KEY7 ADC
*KEY8 LSR
*KEY9 LDX
```

To facilitate entry of the assembler listing type:

```
AUTO 940 <RETURN>
```

and enter each line as prompted. This will prompt you with line numbers that increase in steps of 10. However, four of the program lines contain REM statements on odd line numbers. These are: 965, 1315, 1605, and 2705. They should be omitted when you first enter the program. If you want, enter them last of all, typing in each line number and the REM separately. The lines are not vital to the program's operation so may be left out. When the assembler listing is safely keyed in hit the Escape key and then re-enter line 950 as follows:

```
950 FOR 1% = 0 TO 3 STEP 3
```

and add the following two lines to the program:

```
1 PROCassemble
2 END
```

Now RUN the program. If any errors in syntax are present a suitable error message will be generated informing you of the number of the line containing the error, which can then be checked against the listing and edited. This check ensures that a syntactically correct assembler listing is present. Assembler being what it is though, problems could occur if, say, you typed in TAY instead of TYA. These mnemonics use the same letters but work in opposite directions. To ensure against such an error add the following lines to the assembler program:

```
1 PROCassemble
2 Z% = 0
3 FOR N% = &1100 TO &123B
4 Z% = Z% + ?N%
5 NEXT
6 PRINT "CHECKSUM IS  :";Z%
7 END
```

Next run the program. After a short delay the result

```
CHECKSUM IS: 36468
```

should be produced. These few lines have added together all of the machine code bytes. If your checksum result is different check through your assembler program again.

Once you are sure your assembler listing is correct delete lines 1 to 7 inclusive and re-enter line 950 as it appears in the listing:

```
950 FOR 1% = 0 TO 2 STEP 2
```

Now enter the rest of the Basic program as normal. An ON ERROR trap has been incorporated into this main part so that detailed error messages will be displayed if any occur at run time. When debugging it is worth producing the standard *Acorn User* format listing to screen or printer to help you. To do this first type:

```
WIDTH 40
```

and then list in the usual way. If you've entered the listing exactly as published it should be a simple matter to whizz down it comparing yours line for line.

Finally, if all this looks like too much work there's the *Acorn User* cassette of all the major programs in this issue. A full facility sprite designer – not to mention all the other useful routines elsewhere in the mag – has to be great value at only £3.95!

CONVERTING FOR THE ELECTRON

'DESIGN' can be run successfully on the Electron if a few alterations are made to the listings. Only one actually needs to be made to ensure the running of the program. The other changes are purely cosmetic.

The important change is in line 430. This command tests whether the TAB key has been pressed. Now Elkies will know that their machine does not have a TAB key so we need to specify a key to replace the TAB key. We suggest the DELETE key. To do this re-enter line 430 to read:

```
430 UNTIL INKEY (-90)
```

Alternatively, the COPY key could be specified, using the following:

```
430 UNTIL INKEY (-106)
```

Whichever you choose, you might also like to adjust the program prompt in line 290 to DELETE or COPY in place of TAB. If the DELETE key is being used, line 290 should read:

```
290 COLOUR6:PRINTTAB (2,0) "Press DELETE when" ''
```

followed by the remainder of the line. Be sure to change the TAB inside the quotes and not the print formatting one before it.

The other changes generally involve the use of the Beeb's teletext screen to produce double-height characters. An example is given in line 50 to print SPRITE DESIGN in large teletext letters. The whole of this line could be replaced by a single line:

```
50 PRINT TAB(7,3)"SPRITE DESIGN"
```

on the Electron.

Any other adjustments you care to perform can be done after first running through the program and noting where the changes are that you wish to make.

Finally, line 10 is rather Beeb-specific, as it relates to the Econet system. If this is entered and BREAK hit the Elk will print a lot of gobbledegook and hang up. To avoid this retype line 10 as follows:

```
10 *KEY 10 PA. = &1900|MOLD|M
```

Happy designing!

See 'Problems? No Problem!', page 65

Program 1. One way of solving the currency conversion problem. Four countries are involved

```
 10 REM Bureau de change
 20 REM possible solution
 30 REM only showing 4 countries
 40
 50 REPEAT
 60   PROCinput
 70   PROCprocess
 80   PROCoutput
 90   PROCspace
100   UNTIL FALSE
110
120 DEF PROCinput
130 CLS
140 INPUT''"Which country? "country$
150 INPUT''"English Pounds to change? "pds
160 ENDPROC
170
180 DEFPROCoutput
190 PRINT'"`";pds;" in ";country$;","
200 PRINT'"gives ";
210 IFchangedcash =0 PRINTcurrency$ ELSE PRINT;changedcash;" ";currency$
220 ENDPROC
230
240 DEF PROCspace
250 PRINT'''"Press SPACE to continue. "
260 *FX21,0
270 REPEAT UNTIL GET=32
280 ENDPROC
290
300 DEF PROCprocess
310 currency$="an unknown answer":changedcash=0
320 IF country$ = "AUSTRIA" changedcash = pds * 36:currency$ = "Schillings"
330 IF country$ = "BELGIUM" changedcash = pds * 78.5:currency$ = "Francs"
340 IF country$ = "CANADA" changedcash = pds * 2.75:currency$ = "Dollars"
350 IF country$ = "DENMARK" changedcash = pds * 14.5:currency$ = "Kroner"
360
370 REMetc
380
390 ENDPROC
400
```

Program 2. How you might keep track of cash transactions in a shop

```
 10 REM POINT OF SALE TERMINAL
 20 REMember that return by itself
 30 REM concludes the totalling
 40
 50 REPEAT
 60   PROCinputandadd
 70   PROCtotal
 80   PROCinputcash
 90   PROCcalculatechange
100   PROCshowchange
110   PROCspace
120   UNTIL FALSE
130
140
150 DEF PROCinputandadd
160 total=0:Z%=@%:@%=&20209
170 CLS
180 REPEAT
190   INPUT"Item cost `"cost$
200   IF cost$<>"" total=total+VAL(cost$)
210   UNTIL cost$=""
220 ENDPROC
230
240 DEF PROCtotal
250 PRINT"-------------------"
260 PRINT"Total      `";total
270 PRINT"-------------------"
280 ENDPROC
290
300 DEF PROCinputcash
310 REPEAT
320   INPUT "Cash paid `"cash
330   UNTIL cash>=total
340 ENDPROC
350
360 DEF PROCcalculatechange
370 change=cash-total
380 ENDPROC
390
400 DEF PROCshowchange
410 PRINT"-------------------"
420 PRINT"Give       `";change;" change"
430 PRINT"-------------------"
440 @%=Z%
450 ENDPROC
460
470 DEF PROCspace
480 PRINT'''"Press SPACE for next customer"
490 *FX21,0
500 REPEAT UNTIL GET=32
510 ENDPROC
520
```

XI

See 'Problems? No Problem!', page 65

Program 3. Keeping the right time on a 12-hour clock

```
 10 REM CLOCK ARITHMETIC
 20
 30 REPEAT
 40   PROCinput
 50   PROCprocess
 60   PROCoutput
 70   PROCspace
 80   UNTIL FALSE
 90
100 DEFPROCinput
110 CLS
120 INPUT'"Enter present time. (Just Hours)?
    "nowhour
130 INPUT'"Enter present time. (Just Mins)?
    "nowmins
140 INPUT''"How many hours will pass?
    "passhours
150 INPUT'"How many minutes will pass?
    "passmins
160 ENDPROC
170
180 DEF PROCoutput
190 PRINT''"The new time will be";newhour;"
    - ";newmins
200 ENDPROC
210
220 DEF PROCspace
230 PRINT'''"Press SPACE to continue"
240 *FX21,0
250 REPEAT UNTIL GET=32
260 ENDPROC
270
280 DEF PROCprocess
290 newmins = nowmins+passmins
300 carryhour = newmins DIV 60
310 newmins=newmins MOD 60
320 newhour = nowhour + passhours +
    carryhour
330 newhour=newhour MOD 12
340 IF newhour=0 newhour=12
350 ENDPROC
360
370 REM An alternative proccessing
    procedure:-
380
390 DEF PROCanotherprocess
400 newhour = (((nowmins+passmins)DIV 60) +
    nowhour + passhours) MOD 12
410 IF newhour=0 newhour=12
420 newmins= (nowmins+passmins) MOD 60
430 ENDPROC
440
```

Program 4. A routine to calculate hours worked by staff from clocking on/clocking off records

```
 10 REM CLOCKING ON.
 20
 30 REPEAT
 40   PROCinput
 50   PROCprocess
 60   PROCoutput
 70   PROCspace
 80   UNTIL FALSE
 90
100 DEFPROCinput
110 CLS
120 REPEAT
130   REPEAT
140     INPUT'"Enter the clocking on time
        (Just Hours)? "onhour
150     UNTIL onhour)=7 AND onhour (=12
160   INPUT'"Enter the clocking on time
      (Just Mins)? "onmins
170   UNTIL onhour+onmins/60)=7.5
180 REPEAT
190   REPEAT
200     INPUT''"Enter the clocking off time
        (Just Hours)? "offhour
210     UNTIL offhour(=6 AND offhour)0
220   INPUT'"Enter the clocking off time
      (Just Mins)? "offmins
230   UNTIL offhour+offmins/60 (=6
240 ENDPROC
250
260 DEF PROCoutput
270 PRINT ''"Time worked today:-
    ";hours;" hours, ";mins;" min/s"
280 ENDPROC
290
300 DEF PROCspace
310 PRINT'''"Press SPACE to continue"
320 *FX21,0
330 REPEAT UNTIL GET=32
340 ENDPROC
350
360 DEF PROCprocess
370 onhour = onhour+(onmins/60)
380 offhour =offhour +(offmins/60)
390 morning=12-onhour
400 afternoon=offhour
410 hoursworked=morning+afternoon
420 hours=INT(hoursworked)
430 mins=INT((hoursworked-hours)*60)
440 ENDPROC
450
460 DEF PROCanotherprocess
470 hours=INT((12-(onhour+(onmins/60)))
    +(offhour +(offmins/60)))
480 mins=INT((12-(onhour+(onmins/60))+
    (offhour +(offmins/60))-hours)*60)
490 ENDPROC
500
```



See 'Problems? No Problem!', page 65

Program 5. Can you predict the time a candle will take to burn?

```
10 REM CANDLE CLOCK
20
30 REPEAT
40   PROCgettestinfo
50   PROCgetpredictinfo
60   PROCprocess
70   PROCoutput
80   PROCspace
90   UNTIL FALSE
100
110 DEF PROCgettestinfo
120 CLS
130 INPUT'"How long did the test"'"candle burn? (mins) "time
140 INPUT'"How much was used? (cms) "length
150 INPUT'"What was its diameter? (cms) "diameter
160 ENDPROC
170
180 DEF PROCgetpredictinfo
190 CLS
200 INPUT'"Prediction......"'"Candle length? (cms) "plength
210 INPUT'"Diameter? (cms) "pdiameter
220 ENDPROC
230
240 DEF PROCprocess
250 testquantity= PI*diameter^2*length/4
260 actualquantity= PI*pdiameter^2*plength/4
270 predictedtime= actualquantity * time / testquantity
280 predictedmins= INTpredictedtime
290 predictedsecs= INT((predictedtime-predictedmins)*60)
300 ENDPROC
320 DEF PROCoutput
330 PRINT''"Candle should burn for:- "
340 PRINT';predictedmins;" min/s and ";predictedsecs;" sec/s"
350 ENDPROC
360
370 DEF PROCspace
380 PRINT''"Press space for next candle"
390 *FX21,0
400 REPEAT UNTIL GET=32
410 ENDPROC
420
```

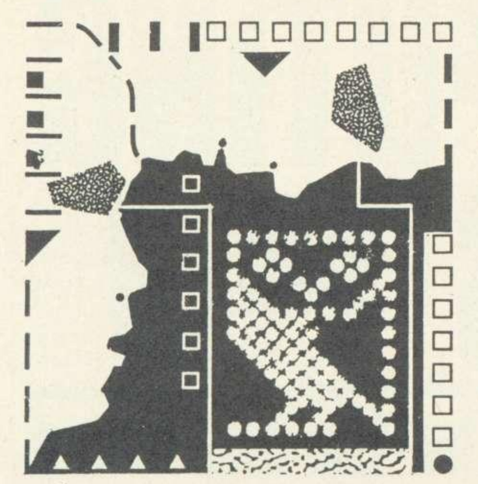
Program 6. A model for calculating population growth

```
10 REM Generation Game?
20 REM population prediction
30
40 REPEAT
50   PROCinput
60   PROCprocess
70   PROCoutput
80   PROCspace
90   UNTIL FALSE
100
110
120 DEF PROCinput
130  CLS
140 INPUT'"How many whole years? "years
150 INPUT'"How many whole months? "months
160 ENDPROC
170
180 DEF PROCprocess
190 population=2
200 generations = years*3 + INT(months/4)
210 PRINT'"Which is ";generations " generations"
220 FOR age = 1 TO generations
230   population=population * 4 / 2 +population
240   NEXT age
250 ENDPROC
260
270 DEF PROCoutput
280 PRINT'"Final population = "population
290 ENDPROC
300
310 DEF PROCspace
320 PRINT'''"Press SPACE to continue"
330 *FX21,0
340 REPEAT UNTIL GET=32
350 ENDPROC
360
```

See 'Formatting at the Double', page 102

Listing 1. Disc formatter that allows formatting of more than one side of a disc at once

```
   10 REM FORMAT
   20 REM Program to allow the formattin
g of more than one disc.
   30 REM G.B.Hill (c) 1984
   40 REM (c) Acorn User, September 1984
   50 MODE7
   60 :
   70 REM *** MAIN PROGRAM ***
   80 :
   90 PROCset_up
  100 NT%=FN40_or_80
  110 PROCchoose_drives
  120 FOR I=1 TO N
  130 DR%=DRIVE(I)
  140 IF FNconfirm_format THEN PROCforma
t(DR%,NT%-1):PROCwrite_directory
  150 PROCsuccessful
  160 NEXT
  170 IF FNyn(2,12,CHR$130+" Format anot
her disc") THEN 110
  180 CLS:PRINT'"RETURNED TO "''"BASIC"'
  190 END
  200 :
  210 REM *** PROCEDURES ***
  220 :
  230 DEFPROCset_up
  240 osword=&FFF1
  250 ENVELOPE1,1,0,-24,0,20,1,40,100,0,
0,-100,100,0
  260 DIM DRIVE(4)
  270 DIM block% 12
  280 DIM sector_list% 39
  290 FOR S%=0 TO 9
  300 sector_list%?(S%*4+1)=0
  310 sector_list%?(S%*4+3)=1
  320 NEXT
  330 DIM directory% 511
  340 FOR I%=0 TO 511:directory%?I%=0:NE
XT
  350 X%=block% MOD 256:Y%=block% DIV 25
6
  360 A%=&7F
  370 *FX15,1
  380 ENDPROC
  390 :
  400 DEFFNyn(x,y,F$)
  410 PRINTTAB(x,y);F$;" (Y/N)? ";
  420 REPEAT
  430 Z=GET AND 223
  440 OK=(Z=ASC"Y" OR Z=ASC"N")
  450 IF NOT OK THEN VDU7 ELSE VDUZ,13,1
0
  460 UNTIL OK
  470 IF Z=ASC"Y" THEN =TRUE ELSE =FALSE
  480 :
  490 DEFFN40_or_80
  500 CLS
  510 PRINTTAB(2,5);CHR$134;"Do you have
 40 or 80 track drives?"
  520 PRINTTAB(2,7);CHR$133;"Type";CHR$1
35;"4";CHR$133;"for";CHR$135;"40 track"
  530 PRINTTAB(2,8);CHR$133;"Type";CHR$1
35;"8";CHR$133;"for";CHR$135;"80 track"
  540 PRINTTAB(14,9);
  550 REPEAT
  560 Z=GET
  570 OK=(Z=52 OR Z=56)
  580 IF NOT OK THEN VDU7 ELSE VDUZ,48:P
RINT" track":pause=INKEY(100)
  590 UNTIL OK
  600 SECTORS%=INT((Z-48)*100)
  610 directory%?&106=SECTORS% DIV 256
  620 directory%?&107=SECTORS% MOD 256
  630 =SECTORS% DIV 10
  640 :
  650 DEFPROCchoose_drives
  660 CLS
  670 FOR I=1 TO 4:DRIVE(I)=10:NEXT
  680 PRINTTAB(0,4);CHR$133;"Type";CHR$1
35;"S";CHR$133;"to silence the sound pro
mpts,"
  690 PRINTTAB(0,6);CHR$133;"any other k
ey for normal running"
  700 IF GET=ASC"S" THEN PROCsh ELSE PRO
Cnoisy
  710 CLS
  720 PRINTTAB(0,3);"Type in the drives
to format.";TAB(0,4);"Type RETURN key to
 terminate choice."
  730 N=0
  740 PRINTTAB(3,6);CHR$130;"Format driv
es: ";
  750 REPEAT
  760 REPEAT
  770 Z=GET
  780 OK=(Z=48 OR Z=49 OR Z=50 OR Z=51)
  790 DONE=(Z=13 AND DRIVE(1)<>10)
  800 IF OK THEN PROCkeepdrive(Z)
  810 IF NOT (OK OR DONE) THEN VDU7
  820 UNTIL OK OR DONE
  830 UNTIL DONE
  840 CLS
  850 PRINTTAB(0,3);CHR$129;CHR$157;CHR$
135;"WARNING  ";CHR$156;"Formatting dest
roys "'" all programs on the chosen side
(s) of"'" the disc(s)."
  860 PRINTTAB(0,7);CHR$133;"Remove Syst
em disc."
  870 PRINTTAB(0,10);CHR$134;"Formatting
 drive";
  880 IF N>1 THEN PRINT"s";
  890 PRINT" ";
  900 FOR I=1 TO N
  910 PRINT;DRIVE(I);
  920 IF I<N-1 THEN PRINT", ";
  930 IF I=N-1 THEN PRINT" and ";
  940 NEXT
  950 PRINTTAB(0,13);CHR$130;"Place disc
(s) in chosen drive(s)."
  960 PRINTTAB(0,16);CHR$131;"Press";CHR
$135;"RETURN";CHR$131;"key to confirm, a
ny other"';CHR$131;"key to abort."
  970 IF GET<> 13 THEN CLS:PRINT'"FORMAT
 ABORTED"':END
  980 ENDPROC
  990 :
 1000 DEFPROCkeepdrive(z)
 1010 z=z-48
 1020 IF z=DRIVE(1) OR z=DRIVE(2) OR z=D
RIVE(3) OR z=DRIVE(4) THEN VDU7:ENDPROC
 1030 N=N+1
 1040 DRIVE(N)=z
 1050 PRINTTAB(18,6+DRIVE(N));CHR$131;"D
RIVE ";DRIVE(N);
 1060 ENDPROC
 1070 :
 1080 DEFPROCsh
 1090 *FX210,1
 1100 ENDPROC
 1110 :
 1120 DEFPROCnoisy
 1130 *FX210,0
 1140 ENDPROC
 1150 :
 1160 DEFFNok(e%)
 1170 IF block%?e%=0 THEN =TRUE
 1180 PRINTTAB(0,15);CHR$129;CHR$157;CHR
$135;"DISC WRITE ERROR AT TRACK ";block%
?7;"   ";CHR$156
 1190 SOUND&11,1,30,12
 1200 =FALSE
 1210 :
 1220 DEFPROCformat(DR%,LT%)
 1230 PROCseek(0)
 1240 CLS
 1250 VDU23,1,0;0;0;0;
 1260 LOCAL S%,T%
```



More on Forth, more on multiple copies on Wordwise, a green View mode, amazing screen dumping ... all hand-picked by Bruce Smith

£5 A to D in Forth

THIS MONTH G P Quinney of Wembley takes over the Forth banner from Richard Clarke (Beeb Forum, July) by providing a short machine code routine to read the analogue to digital converters, although the screen that he provided could readily be changed to perform other OSBYTE calls. The routine (listing 1), does not use the Forth assembler, but this has advantages, as Mr Quinney points out...

The advantages of hand assembling this routine is that it may be loaded directly without first loading the assembler.

First the definition for CODE:

```
: CODE CREATE HERE -2
ALLOT , ;
```

Next, my own routine to replace Basic's ADVAL function.

```
HEX
CODE ADVAL
    ( CREATE DICTIONARY ENTRY )
 86 C,    68 C,  ( STX XSAVE )
0B5 C,     0 C,  ( LDA LOWBYTE )
0AA C,           ( TAX )
0A0 C,   0FF C,  ( LDY #&FF )
0A9 C,    80 C,  ( LDA #&80 )
 20 C, 0FFF4 ,   ( JSR OSBYTE )
 8A C,           ( TXA )
0A6 C,    68 C,  ( LDX XSAVE )
 95 C,     0 C,
    ( STA COMP. STACK LOW )
 94 C,     1 C,
    ( STY COMP. STACK HIGH )
 4C C,           ( JMP )
 6A +ORIGIN ,    ( NEXT )
DECIMAL
```

Listing 1. How to read the analogue to digital converters in Forth, by G P Quinney



Pseudo-variables evaluated

GEOFF SMITH (no relation) of Worcester Park earns himself a portrait of the Duke of Wellington for pointing out that pseudo-variables such as TIME, PAGE and HIMEM can be EVALuated in Basic I provided they are parenthesised, eg:

```
T$="(TIME)"
PRINT EVAL (T$)
```

£5 Wordwise copies in one keystroke

F G JONES of Rossendale has responded to July's tip on multiple copies on *Wordwise* by sending in the method he uses. He says...

I have found those 'awfully nice people' at Computer Concepts have provided the necessary mechanism, without ever having to get involved in anything as low level as Basic.

Section 4 of the *Wordwise* manual explains how to program the function keys to produce key strings, which then simulate the pressing of keys in the given order. For example, if we start in the command menu with the document loaded, we need to:

1. Press Escape (into document)
2. Shift/cursor up (cursor to start of document)
3. Marker (mark start of text)
4. Shift/cursor down (cursor to end of document)
5. Marker (mark end of text)
6. Copy marked text (function key 9)
7. Press Escape (back to menu)
8. Press 6 (print text)
9. Press Return

This copies the document and then prints it. If we put the appropriate key string into one of the function keys we can do all the above with one keystroke from the *Wordwise* menu.

So from the menu type:

```
*KEY2 |[|!|O|!#|!|N|!#|!)|[6|M
```

and then Key 2 used from the menu with CNTL/SHIFT will print two copies of the document in memory.

I can almost hear readers screaming that it is easier to do all that from the keyboard and I agree. The clever thing is not to type it in every time you use the Beeb but to use *BUILD to write an EXEC file to disc. Then it can be taken straight off disc whenever it is wanted.

Taking the steps above, if we wanted three copies then we would proceed to step 6 and then repeat steps 4 and 6 once more, before going on to step 7. For every extra copy required, repeat 4 and 6 at this point.

The obvious procedure would be to write a *BUILD file with Key 2 giving ιwo copies, Key 3 three copies, and so on. See listing 2, for example.

```
*KEY2 |[|!|O|!#|!|N|!#|!)|[6|M
*KEY3 |[|!|O|!#|!|N|!#|!)
      |!|N|!)|[6|M
*KEY4 |[|!|O|!#|!|N|!#|!)
      |!|N|!)|!|N|!)|[6|M
*KEY5 |[|!|O|!#|!|N|!#|!).
      |!|N|!)|!|N|!)|!|N|!)|[6|M
```

Listing 2. Wordwise key codes, from F G Jones

Perhaps the EXEC file could be called *Copier*(!).

The only limitation I have found is the amount of available memory, but few of us ever take advantage of the full 24k-plus usable with *Wordwise*. Frequently, users leave the memory half empty to ensure a mode 0 display using option 7 from the menu. With a copying system as reliable as this, you don't need to use this preview option.



Green characters on the screen

TO KEEP *View* users in check James Miller of Cambridge has sent in the basis of a !BOOT file, which sets the Beeb up with a green *View* mode, doubles the autorepeat speed, redefines the Break key and does the initial NEW.

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Beeb Forum is a platform for ideas, tips and applications relating to the BBC micro and the Electron, intended for experienced programmers to share their thoughts. For every reader's tip published we pay £5 – or more for something special. Contributions should be typed or printed, with substantial listings on cassette. WRITE TO Beeb Forum, Acorn User, Redwood Publishing, London WC2E 9JH.

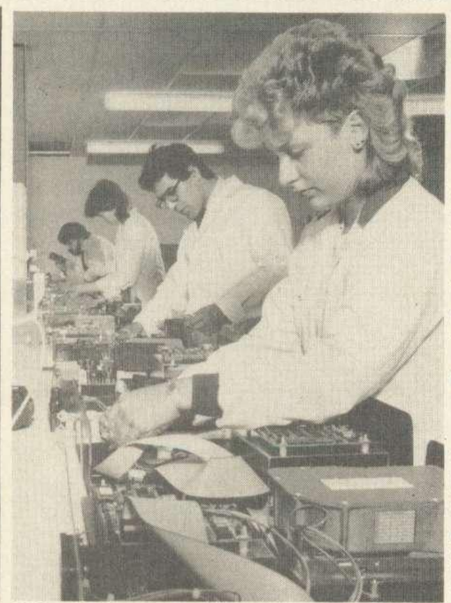


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A new addition to this product list is a removable cartridge drive. This is half-height mini-floppy size. The cartridges themselves are less than 4.5″ square, and contain 5 MBytes of information. The units are front loading, cartridge replacement being performed in a matter of seconds. Cartridge drives may be used in their own right for stand alone systems, or can be integrated into a system with a large, fixed hard disk for back-up purposes, providing an economical alternative to a tape streamer.



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Winchester Disc Drives are put through a 24 hour intensive test programme prior to despatch to customers around the world.

All Winchester systems are fully cased, and self contained, the only connection required, apart from mains, is to the 1MHz bus connector of the BBC micro. The WFS or network (E-Net) firmware is supplied on Eprom. Fully rack mounted systems may also be provided, and other facilities available include a real time clock, and a link board for connecting two micros to one Winchester system.

New Winchester Backup Facilities

Backup of the E-Net fileserver Winchester has up to now been limited to selective transfer of user areas to floppy disk. In order to augment this, the following facilities are now (or shortly will be) available.

(a) Backup of user attributes to floppy disk. (Available on application)

(b) Full backup of the filesaver drive to a second (similar) Winchester unit. (This should be available within few weeks)

(c) Full backup to removable cartridge drives. At present only 5 MByte units have been evaluated, necessitating the use of two cartridges for backup of a 10 MByte Winchester. (Expected availability is 1 to 2 months)

(d) Full backup to tape streamer (20 or 45 MBytes). (Expected availability is 2 months).

Existing single Winchester systems can be upgraded to contain backup units for any of options (b), (c) and (d), additional hardware being accommodated within the current casing. At present the most cost effective solution for pure backup purposes is likely to be option (b), with (d) the most costly, though in the latter case some improvement is hoped for before the end of the year. Prices are available on application.

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Mr Miller explains . . .

The advantage of setting the screen to green characters is that only one gun of the monitor is on, which gives a very crisp display, as well as being quite restful.

Method: create two files (using VIEW), called $. !BOOT and $. !BOOT2 as in listing 3.

Notes:

1. To use, do a SHIFT/BREAK.

2. It is assumed that the computer initialises to mode 3.

3. *TV255, 1 moves the display down one line so that the first line is visible, and stops flicker by turning off the interlace. MODE 3 does the obvious, and actions the *TV command.

4. *FX155,nnn perform the mode 3 equivalent of VDU19, 1, 2, 0, 0, 0. VDU instructions will not work from within *View*.

5. Normally, Break would reset the computer to 'standard', so redefining the key allows easy recovery of colour, auto repeat, the vital OLD, as well as a useful *FX125 (escape) into text mode.

. . . Mr Miller would like to know how to redefine the cursor colour. Can anyone help?

```
*| $.!BOOT BBC=WP
*WORD
*TV255,1
MODE 3
*KEY10 *EXEC $.!BOOT2|M
NEW
```

```
*| $.!BOOT2 set grn,
      auto rpt spd,
      OLD, escape
*FX155,130
*FX155,146
*FX155,162
*FX155,178
*FX155,194
*FX155,210
*FX155,226
*FX155,242
*FX12,4
OLD
*FX125
```

Listing 3. James Miller's basis of a !BOOT file for setting up a green screen with View

£20

Mode 0 dumps in under five minutes

SOME excellent mode 0 screen dumps have been sent in by Bernard Beeston of Enfield. What is so surprising is that they were produced using a single line of program (listing 4) and it will work on an Epson, Star and Shinwa CP80 printer.

In Mr Beeston's words . . .

This was written as a GOSUB but it could just as well be a PROC or GOTO, or just a line in the main program.

The MOVE0, 0 at the beginning overcomes the POINT bug in the 0.1 OS.

Within the last few weeks I have written an even better mode 0 dump, which although still in Basic takes only about $4\frac{3}{4}$ minutes – yet it almost fills an A4 sheet. I calculate that the printer runs at the rate of about 1900 printer pixels per second and as the printer is busy almost all the time I doubt if a machine code routine would speed things up much.

Here is the new program (listing 5), which this time has to be in two lines. As with listing 4 I have given it nominal line numbers.

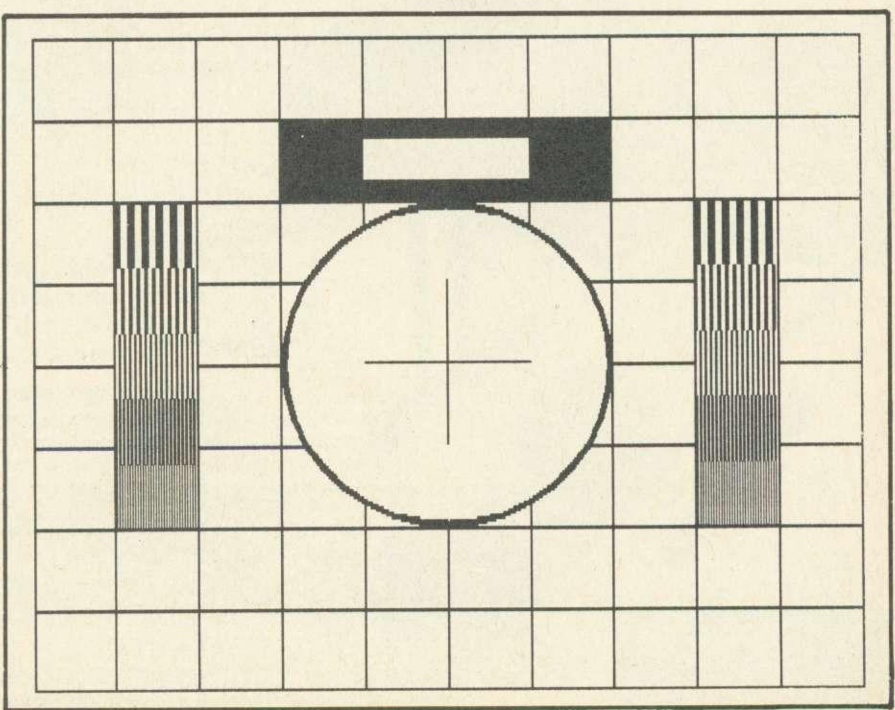
One snag with this routine is that the screen must not be allowed to scroll as the screen memory is read directly. I enclose a few samples from both programs.

```
   900 MOVE0,0:VDU29,0;0;2,1,27,1,51,1,24
,1,13:FORY%=1023TO0STEP-32:VDU1,27,1,76,
1,22,1,2:FORW%=0TO6401STEP12:X%=W%/5:A%=
0:FORZ%=2TO30STEP4:A%=A%*2+POINT(X%,Y%-Z
%):NEXT:VDU1,A%:NEXT:VDU1,10,1,13:NEXT:V
DU1,27,1,64,3:RETURN
```

Listing 4. One-liner from Bernard Beeston that produces good mode 0 screen dumps from various printers. It takes about seven minutes

```
   900 VDU2,1,27,1,51,1,24,1,13:A%=32135:
REPEAT:VDU1,27,1,76,1,64,1,3:FORB%=A%TOA
%-19840STEP-640:FORC%=B%TOB%-7STEP-1:VDU
1,?C%,1,?C%,1,?C%:IFC% MOD 4=0VDU1,?C%
   910 NEXT,:VDU1,10,1,13:A%=A%+8:UNTILA%
>32767:VDU1,27,1,64,3:RETURN
```

Listing 5. Two-liner from Mr Beeston that executes dumps in less than five minutes



Just testing . . . Sample dump produced by Bernard Beeston's one-line routine



Teletext editing

A USEFUL machine code program that enables teletext characters to be edited on the screen comes from Jon Warmisham. Jon writes . . .

The routine (listing 6) is called with CALL&1800 (or whatever P% is set to) and makes only the keys Q,W,A,S,X,Z and the cursor keys active. The letter keys correspond to the six character cells of a mode 7 graphic character and when the cursor is positioned under a character, each cell can be turned off and on independently. Pressing Escape returns command to Basic and normal editing can continue.

If a program line is edited in this way it must be copied with the copy key as the edited image is only a 'screen image'. The routine saves the time and trouble of looking up each corresponding character code while typing in strings. I use the upper ASCII code table to enable the full set of graphics shapes.

Together with the function-key set up published in the May edition, this routine gives a full teletext editor available in command mode.


```
  10 REM Routine for editing mode 7
  20 REM graphics in command mode.
  30 REM Use CALL&1800 to activate.
  40 REM Press <ESC> to return to BASIC.
  50 REM  Jon Warmisham (c) 1984
  60 REM Keys : Q  W
  70 REM         A  S
  80 REM         Z  X
  90 REM Correspond with the 6 pixels
 100 REM of a Mode 7 graphic character.
 110 MODE 7
 120 temp=&70
 130 FORPASS=0TO3 STEP3
 140 P%=&1800
 150 [OPT PASS
 160 .loop LDA£&4    \  *FX 4,1 Cursor keys
 170 LDX£1           \ now return codes
 180 JSR&FFF4        \   &88 to &8B
 190 LDA£&F          \ flush keyboard
 200 LDX£1           \     buffer
 210 JSR&FFF4        \   via osbyte
 220 LDA£0           \ load Acc. and Y
 230 TAX             \ registers with 0
 240 JSR&FFE0        \ osrdch routine
 250 CMP£&1B         \ is it <ESC> ?
 260 BNE over        \ no.. jump over.
 270 LDA£&7E         \ acknowledge <ESC>
 280 JSR&FFF4        \ via osbyte and
 290 LDA£&4          \ reinstate cursor
 300 LDX£0           \ editing for a clean
 310 JSR&FFF4        \ return to BASIC
 320 RTS
 330 .over CMP£&51   \ is key 'Q'?
 340 BEQ q           \ yes. jump to q
 350 CMP£&57         \ is key 'W'?
 360 BEQ w           \ yes. jump to w
 370 CMP£&41         \ is key 'A'?
 380 BEQ a           \ yes. jump to a
 390 CMP£&53         \ is key 'S'?
 400 BEQ s           \ yes. jump to s
 410 CMP£&5A         \ is key 'Z'?
 420 BEQ z           \ yes. jump to z
 430 CMP£&58         \ is key 'X'?
 440 BEQ x           \ yes. jump to x
 450 CMP£&88         \ is key 'left cursor'?
 460 BEQ left        \ yes. jump to left
 470 CMP£&89         \ is key 'right cursor'?
 480 BEQ right       \ yes. jump to right
 490 CMP£&8A         \ is key 'down cursor'?
 500 BEQ down        \ yes. jump to down
 510 CMP£&8B         \ is key 'up cursor'?
 520 BEQ up          \ yes. jump to up
 530 BNE loop        \ no? back to loop
 540 .down LDA£10    \ vdu 10
 550 JSR&FFEE        \ move cursor.
 560 JSR loop
 570 RTS
 580 .q LDA£&1       \ store value in
 590 STA temp        \ zero page
 600 JSR read        \ jump to read...
 610 JSR loop        \ back to loop.
 620 RTS
 630 .w LDA£&2       \ store value in
 640 STA temp        \ zero page
 650 JSR read        \ jump to read...
 660 JSR loop        \ back to loop.
 670 RTS
 680 .a LDA£&4       \ store value in
 690 STA temp        \ zero page
 700 JSR read        \ jump to read...
 710 JSR loop        \ back to loop.
 720 RTS
 730 .s LDA£&8       \ store value in
 740 STA temp        \ zero page
 750 JSR read        \ jump to read...
 760 JSR loop        \ back to loop.
 770 RTS
 780 .z LDA£&10      \ store value in
 790 STA temp        \ zero page
 800 JSR read        \ jump to read...
 810 JSR loop        \ back to loop.
 820 RTS
 830 .x LDA£&40      \ store value in
 840 STA temp        \ zero page
 850 JSR read        \ jump to read...
 860 JSR loop        \ back to loop.
 870 RTS
 880 .read LDX£0     \ empty X register
 890 LDA£&87         \ read character at
 900 JSR&FFF4        \ cursor and transfer
 910 TXA             \ to Accumulator
 920 EOR temp        \ exclusive-or with temp
 930 ORA£&80         \ adjust to higher
                       ASCII table
 940 JSR&FFEE        \ send to screen
 950 LDA£8           \ back space to
 960 JSR&FFEE        \ original position
 970 RTS
 980 .left LDA£8     \ vdu 8
 990 JSR&FFEE        \ move cursor.
1000 JSR loop        \ back to loop.
1010 RTS
1020 .right LDA£9    \ vdu 9
1030 JSR&FFEE        \ move cursor.
1040 JSR loop        \ back to loop.
1050 RTS
1060 .up LDA£11      \ vdu 11
1070 JSR&FFEE        \ move cursor.
1080 JSR loop        \ back to loop.
1090 RTS
1100 ]
1110 NEXT PASS
1120 END
```

Listing 6. Jon Warmisham's teletext character editing program

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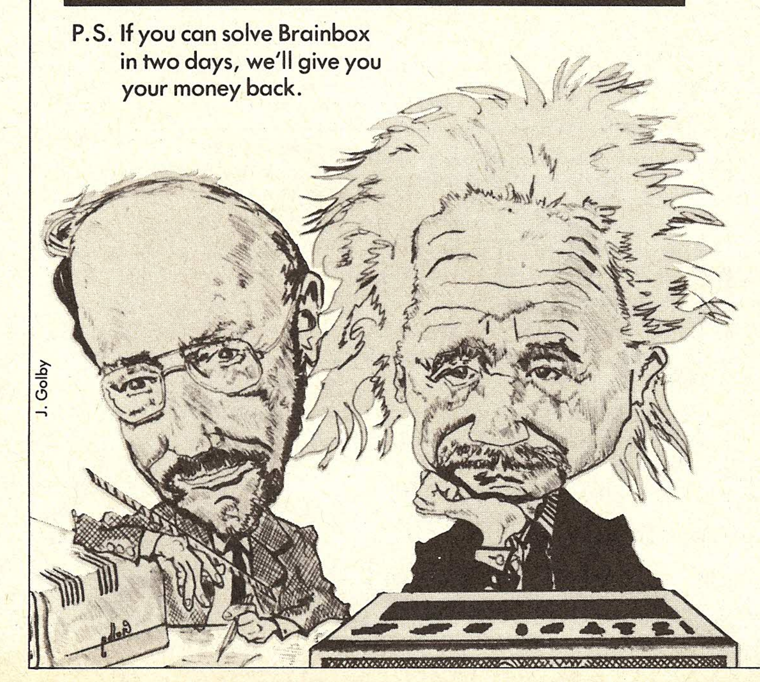
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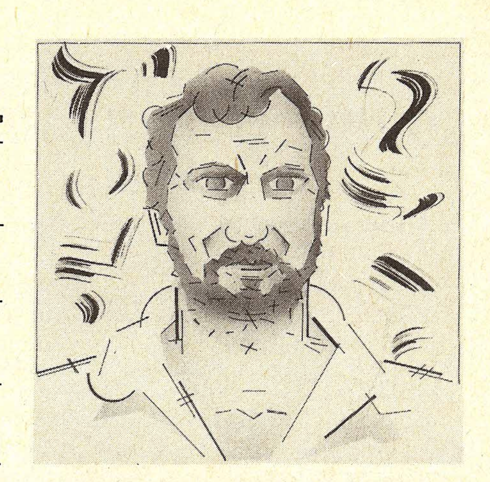
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A roll-your-own disc formatter can be a faster, more powerful tool than the utility supplied with the drive. Take George Hill's, for example

FORMATTING AT THE DOUBLE

WHY write your own disc formatter when there's already one provided as a utility with drives? Well, first out of interest and to aid understanding – but also because the distributed format programs have serious shortcomings. For example they rarely allow you to format more than one side of a disc at once. Program 1 is a disc formatter in Basic which does this: and will format 40 and 80 track discs. The other program section attached to this article is an addition to the COPYDSC program published in May's *Acorn User*. This allows you to format and copy in one operation.

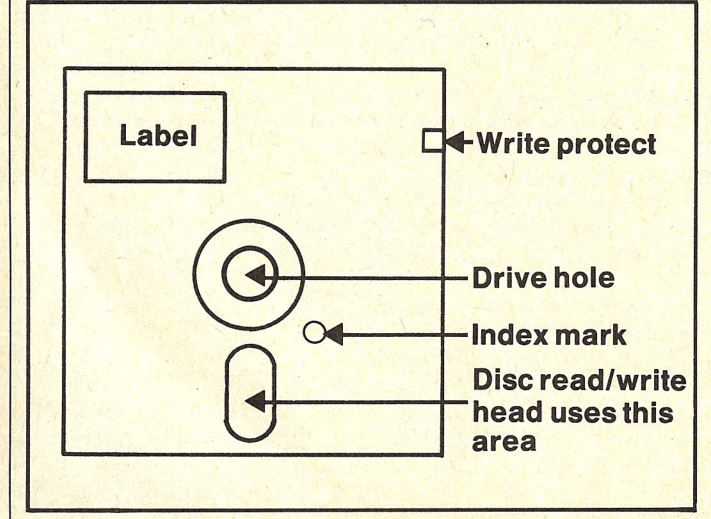
What is formatting? The formatting process is like cutting grooves on a blank record. On a blank record without any grooves, the needle has no idea where to go, and so slides over the surface at random. Once grooves are cut the needle will not play any music, but the grooves can be modified to make sounds. In the corresponding process on a floppy disc we need to control the disc read/write head, and lay down patterns of magnetic fields on the disc surface. Some of these patterns are for the disc controller to use when positioning the head and some are for the actual storage of data. The patterns represent binary digits in groups of eight (ie in bytes).

The general layout of a disc was shown in the May issue, and is reproduced in figure 1 (note the sectors are numbered from 0 to 9, *not* 1 to 10). How does the disc operating system know where the tracks and sectors begin and end?

The start of a track is marked by a hole in the disc! If you look at a disc you will see a small hole in the cardboard cover to the right of the central drive hole. If you (carefully – touching the disc only inside the central hole) rotate the disc within its cardboard sleeve, a physical hole in the plastic disc will appear. This is the 'index mark'. On each track a magnetic pattern is laid down to produce a blank space at the start of the track, with a similar pattern at the end. These patterns serve two purposes. The first is to act as a purely physical space, and the second is to provide synchronisation pulses to enable the disc controller to get in step with the data it is about to read. These magnetic patterns are called 'gaps'. In each gap the number of synchronisation (sync) bytes is six – all automatically set to 0. You can alter the number of &FF values sent as separators, and the number you have chosen is sent to the registers of the 8271 FDC (floppy disc controller) chip via OSWORD parameters.

There are five types of gap: gap 1 is at the start of the track; gap 2 is at the start of the data section of each sector; gap 3 is at the end of the data section; gap 4 is 'padding' to ensure each track

Program 1 and the COPYDSC enhancer referred to are listed on yellow pages xiv and xv



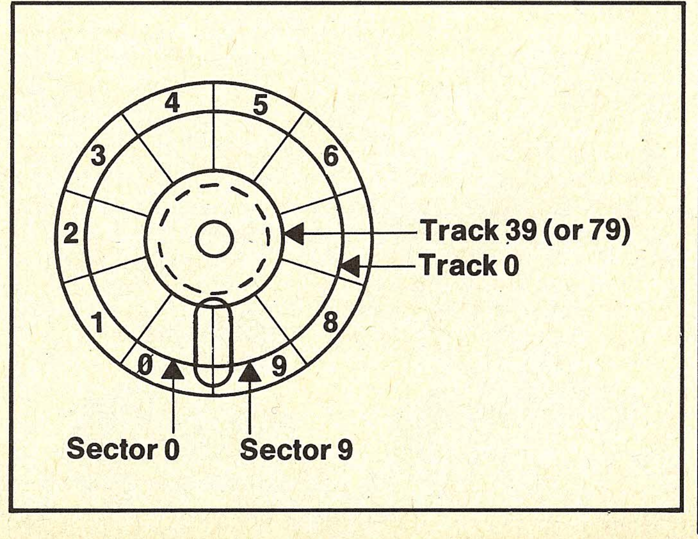


Figure 1. Disc layout

starts and finishes at the index mark, independent of the number of sectors per track used. (The Beeb uses 10 sectors per track each of 256 bytes, but the 8271 can support other numbers of sectors per track, and other numbers of bytes per sector). Gap 5 is the gap at the end of the last sector. You can fix the number of 'spacing bytes' in gaps 1, 3 and 5.

Each sector has fixed patterns in it to act as sector identification (ID). Some of this information must be supplied by you in the form of a block of information for each track (stored at sector_list% in the formatting program). Some is worked out for you by the 8271 in the form of head addresses, and cyclic redundancy check numbers. The sector_list% information is in the form of four numbers per sector. The first is simply the track number, the second is always 0. The third is a number between 0 and 9 which serves to identify that particular sector. (It is calculated by a curious algorithm which generates a sequence of digits starting at 7, and increasing by one until the end of the track, then restarting at some other number.) The last is a one, indicating that we are using 256 bytes per sector. On the disc these are preceded by a single byte acting as a spacer, and followed by two bytes of check digits.

This information is summarised in figure 2, which shows how a track is laid out.

How do we go about formatting a disc, or indeed a single track? Space must be reserved for the blocks of information which will have to be passed via OSWORD. (For the general form of OSWORD commands see the May issue and the *User Guide*.) This is done in PROCset-up. The main block is 13 bytes long (DIM block% 12). The sector ID information block is 10 × 4 = 40 bytes long (DIM sector_list% 39).

Before formatting is started, the disc head must be moved to a known position. As this cannot be read from the unformatted disc, it must be a position known to the 8271. This is the start of track 0, and is found by the SEEK command.

The OSWORD information block must contain the drive number as the first byte, and the buffer address as the next four bytes. Here no reading or writing takes place, so the buffer address is a dummy (&B000 is above the OS ROM where it can do no damage!). The command number is always passed to OSWORD as byte 7 (at block%?6). For a seek it is &69. There is only one parameter, the track number, so block%?5 is 1, and block%?8 is the track number (here 0). Error codes are always deposited in the byte after the last parameter, here in block%?8 which is emptied. On calling OSWORD (the operating system routine located at &FFF1) with the accumulator set to &7F (for disc read/write operations) the disc read/write head is moved to track 0.

Now we can start formatting. The OSWORD block is set up as follows:

- block%?0 is the drive number.
- the next four bytes point to the sector ID list (block%!1 = sector_list%).
- there are five parameters (block%?5 = 5).
- the formatting command is &63 (block %?6 = &63).
- the programmable gaps are:
  gap 1 – 16 bytes of &FF (block%?11 = &10)
  gap 3 – 16 bytes of &FF (block%?8 = &10)
  gap 5 – 0 bytes of &FF (block%?10 = 0) – the 8271 manual suggests this gap is unused on 5.25 inch floppies.
- there are 10 sectors per track of 256 bytes each (block%?9 = &2A).
- the current track number is in block%?7.
- the error code is deposited in block%?12.

The track number, and the sector IDs will need amending for each track, but the rest can stay constant during formatting.

When OSWORD is called, the formatting pattern for that track is laid down. All the bytes in the data sections of each track are initialised to 11100101 binary (E5 hex). Thus if you look at any sector of the disc (except sectors 0 and 1 on track 0) immediately after formatting, it will show everything as E5.

Figure 2. Details of a track

The whole operation takes place in PROCformat (drive, number of tracks), which will cope with 40 or 80 track drives. The remainder of the program is concerned with the peripheral operations necessary to make this a user-friendly, and fairly foolproof program.

These are: first, setting up all the necessary storage, and initialising the Accumulator, X and Y registers for OSWORD calls (via A%, X% and Y%). This is all done in PROCset_up. Next, checking the number of tracks to format (FN40or80). Third, selecting which side(s) of which disc(s) to format (PROCchoose_drives). This procedure also allows you to turn off the sound (PROCsh and PROCnoisy) and issues the necessary warning messages before proceeding. Fourth, making sure the disc to be formatted is not already formatted, and insisting that you confirm your intentions if it is (FNconfirm_format). Finally, error checking (FNok).

When the formatting operation is complete, there is still one thing left to do. This is to write essential information into the directory sectors. These are track 0, sectors 1 and 2. The whole of these sectors should be initialised to zero *except* the bytes which tell the DFS how many sectors there are on the disc when it is subsequently read or written to. This is a two-byte number stored at bytes 7 and 8 of the second sector of the directory. A dummy directory has been initialised in PROCset_up (DIM directory% 511). The two important bytes have been altered in FN40or80. The two sectors are now

written to the disc in PROCwrite_ directory, and a triumphant chord sounds if all is well (PROCsuccessful).

Modifications of these processes can be grafted on to the Copydisc program published in May. These should be typed in and saved as normal. You also need a spooled copy. This is generated by:

```
*SPOOL FORMBIT
LIST
*SPOOL
```

Now load the copying program. Typing:

```
*EXEC FORMBIT
```

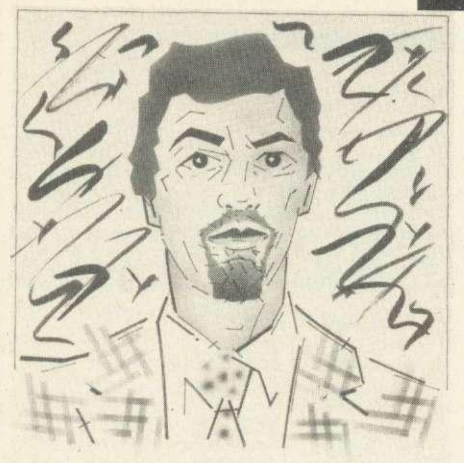
will merge the two programs, overwriting some lines, and adding the rest. The whole should be listed, to check that all has gone according to plan, and then saved as normal.

I must repeat the warning from the last article. Programs which mess about with discs are potentially lethal! *Never try them out on a disc containing valuable programs.* The program does *not* carry out verification. This involves a separate OSWORD call which I hope to cover in a separate article.

Lastly a couple of tips about the speed of operations. First, many disc drives do not need the long settling-down periods allowed for by the default settings in the BBC micro. They can be altered by *FX255 – but will be reset on a BREAK, which is a bore. Better, install a DIP (dual in-line package) switch at the bottom right hand corner of your keyboard. The holes are already there, it just takes some courage and solder to fit a cheap standard switch. Alternatively, ask your dealer to do it for you. You can then experiment with the settings of switches 3 and 4 (numbering from the left). Having these two switches on and the rest off vastly improves the performance of my Cumana Mitsubishi drives. (The other switches can be used to alter the mode selected on BREAK – quite fun, but only useful if you want your machine dedicated to graphics.)

'With the new DNFS chip – whoosh! The Basic program is now faster than the old machine code formatter, and Wordwise no longer clicks'

Second, the new combined DNFS (disc and network filing system) chip being distributed with the 6502 Second Processor is vastly faster than the original DFS. Users of *Wordwise* will have been irritated by the constant clicking as the DFS performs its text loading and saving operations. This seems to be due to the slow speed at which the OSWORD calls were intercepted and carried out by the old DFS. The formatter clicks after each track with the old DFS, but with the new DNFS – whoosh! The Basic program is now faster than the old machine-code formatter, and *Wordwise* no longer clicks! You do not have to have the network upgrade for the DNFS to work on a normal disc machine, so no disc user should be without one. It has one notable disadvantage: you can no longer have coloured disc titles!


Paul Beverley

Paul Beverley and Nigel Eames, in quest of a better random number generator, offer three alternatives: one software and two hardware

HIGH-SPEED RANDOM NUMBERS

LAST month, in this series of articles about how the BBC micro works, we looked at the random number generator (RNG), which is implemented in Basic. Having established that random numbers are generated by using a software algorithm, we looked at ways of speeding this process up, first by accessing the machine code programs directly rather than through the RND function, and secondly by writing a simpler and faster algorithm.

This month we look at three ways of speeding things up even more. There is an even better software generator and then two hardware generators that can be connected to the computer via the user port. The first hardware generator (figure 1) uses a purely digital circuit and is in fact a hardware version of the algorithm used in the Basic interpreter – ie, a shift register with exclusive-OR feedback. The second (figure 2) is a 'true' random number generator as opposed 'pseudo-random'. It uses the analogue technique of amplifying the random noise generated by an electronic component.

'The random number generator algorithm in Hi-Basic is much faster than the one in Basics I and II'

Software RNG

The random number generator algorithm in Hi-Basic (as used on second processors) is much faster than the one in Basics I and II. To be precise, the subroutine in Basic I and II that generates each four-byte (32-bit) random number takes 714 microseconds, whereas the equivalent subroutine in Hi-Basic, even when run on the standard machine, takes only 156 microseconds – a considerable saving.

In the original subroutine, a 33-bit number was shifted 32 times, one bit at a time, to produce the new number. To improve the speed, Hi-Basic shifts the 33-bit number one *byte* at a time and therefore makes only four. shifts. Although the routine itself is longer, since it is done only four times it is a lot faster. This new routine is shown in program 1. This program uses the routine with only a single byte-shift to show how to produce single-byte random numbers, but for a four-byte number you would CALL or JSR the routine starting from "newRND" (line 40) – ie, entering the 'next byte' routine (line 70) with the Y-register containing 4 – and then pull out the resulting number from locations &0D to &10. If you are using Basic then you would use !&0D.

Digital RNG

The digital random number generator consists of two eight-bit shift registers in series (2 x 74LS164), with exclusive-OR gates applying feedback to the data input, forming what is known as a ring-counter or chain-code generator. The number produced by this ring-counter is read into the 6522 VIA shift register through the CB2 line, while the CB1 line provides clock pulses to do the shifting. When the register is not being read, it is continuously shifted by a 5MHz clock consisting of a simple Schmitt trigger astable circuit. The PB7 line from the VIA is used to disable this oscillator while the shift register is being read by the VIA.

If the PB0 line, which is also exclusive-ORed in with the feedback, is kept at a constant logic level then the shift register will go through a fixed cycle of (2^16–1) states (65535). This does not seem to compare very favourably with the software RNG implemented in Basic, which uses a 33-bit shift register, but there are two ways in which the randomness is improved. First, the 5MHz clock is exercising the ring counter all the time, except when it is being read, unlike the Basic RNG, which is shifted only when a new number is called for. Thus the numbers returned by the hardware RNG will depend on how long it is since the register was last accessed. Also, the clock is free-running which means that the way it shifts the ring counter is totally independent of the operation of the processor.

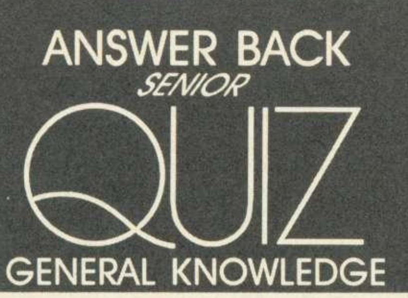
The second added randomness is that the PB0 line, which is also exclusive-ORed into the feedback line, is inverted every time an IRQ interrupt occurs. This means that at least every 10 milliseconds – usually more often – the data chain of the ring counter is altered. Again, as with the 5MHz clock, this event is independent of the timing of the main program.

Analogue RNG

As with the digital RNG, the number is read into the computer by using the VIA shift register. The data is latched from a bistable, which itself is clocked by digital noise generated by amplifying the noise from a zener diode noise source. The reason for using the bistable is that the raw data, amplified from the zener, may not spend equal times high and low which, if read directly, would therefore produce bias towards those numbers with more bits at logic 1 or more bits at logic 0.

The analogue part of the circuit consists of a high-gain, high-bandwidth amplifier, driving a transistor switch. This clocks a negative edge triggered bistable so that the bistable output is dependent on the random frequency

Please turn to yellow pages i and ii for the two listings referred to in this article



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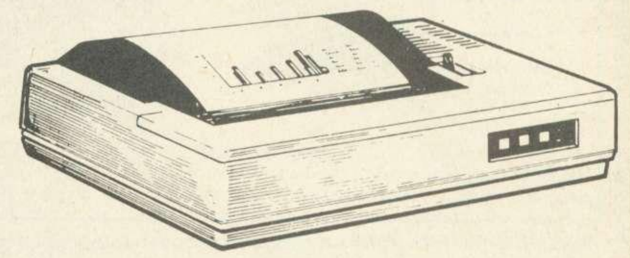
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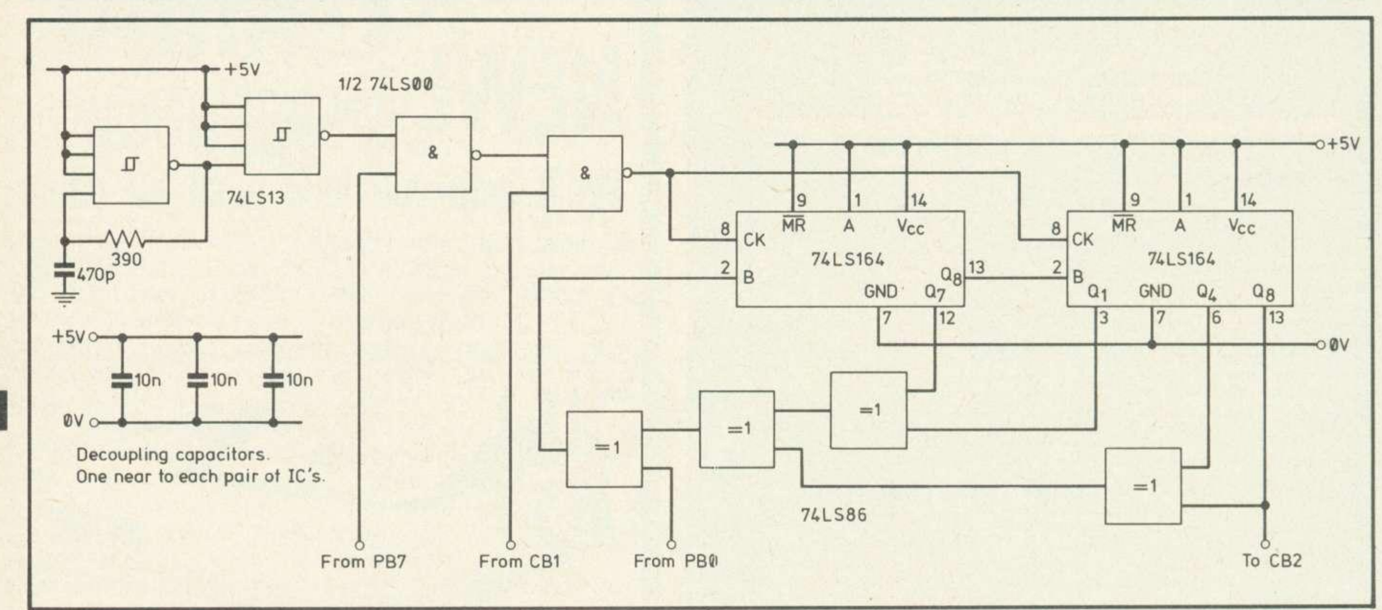


Figure 1. Circuit diagram of the digital random number generator

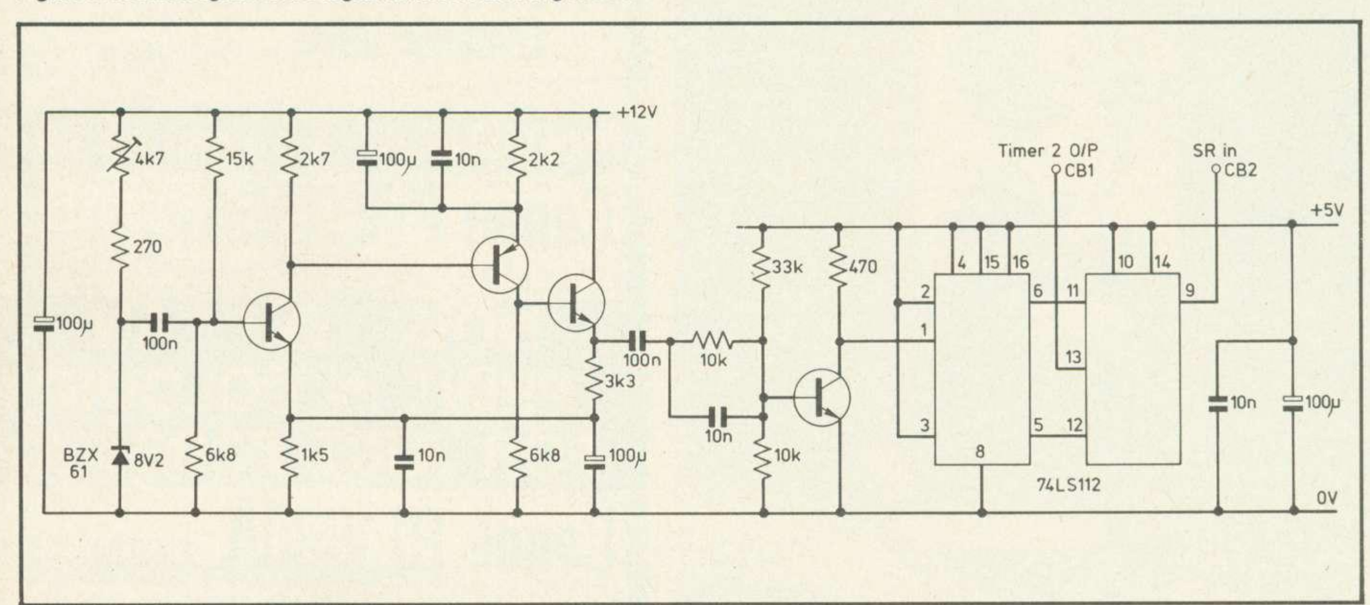


Figure 2. Circuit diagram of the analogue random number generator

changes rather than the amplitude changes of the noise source. The outputs of the first bistable are fed into the J and K inputs of the second bistable, which latches the data on the negative going edge of the CB1 output.

Software for the hardware

Program 2 shows the control software for the two hardware RNGs, plus tests to check their randomness. These are the two tests that we used last month for checking the software RNGs. The subroutines necessary for the digital RNG are in lines 820 to 1300, and those for the analogue RNG in lines 1340 to 1560.

The test routines occupy lines 1720 to 2210.

Clearly this program as a whole shows all the routines needed to test *both* RNGs, which in practice you will not want to do, but it should be easy enough once you have decided which generator to use to type in only the lines you need. You will need to use this program if you make a generator, as it will show you whether or not the hardware is working correctly. This is especially important in the case of the analogue RNG because the maximum speed at which you can read it is determined by the bandwidth of the amplifier, and that will depend finally on the transistors used and even the layout of the components on the printed circuit board.

When the tests are run, you will find that the histogram shows a degree of 'drooping' at each end if you are trying to read it too fast. That is to say that numbers with lots of zeros or lots of ones occur less often than average. The prototype needed a delay of six to ensure that there was no visible bias on the histogram test.

Which RNG?

If you need to produce random numbers more quickly than the Basic random number generator is capable of, which of the three suggested here would be most suitable?

In terms of speed, the digital RNG is the fastest at 20 microseconds per eight-bit number; the new software RNG is next at 44 microseconds; and the analogue slowest at 128 microseconds. One point to note, though, is that with the two hardware generators, the time quoted is the maximum time between readings rather than the length of time taken to do the reading. In other words, during the time that the VIA is busy shifting in the new value, the processor can be doing some cal-

culations with the previously generated number.

The minimum time needed to read the digital RNG is five microseconds, assuming that the X register is available with zero in it to put into the high byte of Timer 1, and that you do not bother checking whether the timer 1 flag is set. If you do this, you must be sure that the time taken to process each number is greater than 15 microseconds. If you try to read the number too soon then you will get an incorrect reading and the randomness will be reduced.

To read the analogue RNG, again assuming that you do not try to read it too soon, takes only 2.5 microseconds – the time of an LDA &FE6A.

Clearly the software generator is the easiest to implement since no hardware needs to be made available. This would be a considerable advantage if, for example, you wanted a class of students to run the same simulation on each of say 10 microcomputers. Also, this generator can be used on the Electron directly, whereas for the hardware RNGs you'd need to add a 6522 VIA interface (as explained in *Acorn User*, December 1983). Remember though that the timings on the Electron will be different as the RAM works at half the speed of the ROM.

Which of the two hardware generators you think is simpler to construct depends on whether you prefer to make up digital circuits or analogue circuits. In terms of software though, as you can see from program 2, the digital generator needs more instructions – an interrupt routine needs setting up, and you need to control Timer 1 instead of it working entirely automatically on Timer 2, as with the analogue generator. Also the digital generator uses two extra control lines – PB0 and PB7.

It would be helpful to know which one gives the 'best' random numbers. Unfortunately the two tests we have used can only show whether there are any obvious defects. In theory though, since the analogue generator is based on a truly random process, it should be the best. Whether it is or not, and which of the other two generators is the better, we cannot as yet say, since we know of no more rigorous tests. We issued a plea last month for any tame statisticians who know how we could test our generators to contact us via the editor, but so far we've had no response. When we do, we'll publish the results for all the generators that we've looked at in both articles.

Next month: If you have made up the digital random number generator you'll be well on the way to having a system that can be used to 'exercise' different parts of your computer. You'll be able to find out if there are any faults in the computer's hardware, and go some way towards locating them through a process known as 'signature analysis'.

ARIES UPGRADE FOR WORDWISE

Jacquetta Megarry finds the advantages . . . and snags

Wordwise-Aries wordprocessing ROM, BBC, Computer Concepts, £46 inc (or £10 in exchange for Wordwise ROM)

A NEW version of the Wordwise wordprocessing ROM for the BBC micro is now available. The upgrade costs £10 if you return your existing chip to Computer Concepts; new customers can get the latest version from dealers at the same price as the old.

Called the Wordwise-Aries, the upgrade – now being sold as the standard Wordwise ROM – has been designed to capitalise on the Aries RAM expansion board from Cambridge Computer Consultants. With the Aries B20 board fitted, Wordwise users can preview the format of long documents at 80 characters per line. In the previous standard set-up, this was only possible up to around 1,500 words; longer documents have to be previewed at 40 characters per line, making format difficult to check. The overall word limit (about 4,500 words) for a Wordwise text file remains the same.

Users without the Aries board may still prefer the new Wordwise, as it incorporates worthwhile extra features without any vices of incompatibility. Pauses can be forced during preview or printing instantaneously by pressing the space bar, or in advance by inserting an embedded command into the text. This is useful to arrest unwanted scrolling or to permit a change of daisywheel.

A powerful new feature allows commands to be passed to the BBC's operating system from *within* the text. For example, the embedded command OS"CAT" would cause a catalogue of all the files held on disc to be printed as part of the document. Using the OS command to access other ROMs or files, you can make spreadsheets, screen dumps of graphics and fancy lettering an integral part of documents printed out under Wordwise.

Other features of the Wordwise-Aries include the ability to switch between or suppress printers at the output stage and the option to print multiple copies automatically using a machine code routine.

What are the snags with the new arrangement? The main benefits will only be felt if you buy the Aries board, which means spending another £99.95. However, this gives you 20k of extra RAM for Basic programs too (making 51k addressable in mode 7). It will not fit if you already have a sideways ROM board – essential for combining Wordwise with other firmware like the Graphics ROM, the new Printmaster, Microtext and spreadsheet or database chips. However, Cambridge Computer Consultants has brought out a compatible board (the B12) at £46 which accepts 12 ROMs. The B20 and B12 can both be fitted at once and together they represent a major upgrade to an already powerful machine. This is an option which should be considered by anyone who regularly uses Wordwise on long documents or who finds the 32k RAM limit restrictive.

What I greatly regret is that the opportunity was not taken to correct Wordwise's unfriendliest feature: the system will accept an instruction to save to a filename already in use without asking if the user really means it. So if you hit Save by mistake instead of Load (easily done as they are adjacent on the menu) you can overwrite a live file with an empty memory. Designer Charles Moir is aware of this problem and considered trapping it. Alas, the Aries modifications left too little space on the ROM. But I bet more people have accidentally lost a file this way than have been handicapped by the 40-column preview. Let's hope Computer Concepts does a fresh upgrade for occasionally absent-minded users like me.

Computer Concepts is at 16 Wayside, Chipperfield, Herts WD4 9JJ. Tel (09277) 69727.
Cambridge Computer Consultants is at Science Park, Milton Road, Cambridge CB4 4BH. Tel (0223) 862614.

John Vaux wraps up his Z80 bundle of reviews with a look at Nucleus and the languages

YOUR OWN MASTER FILES

IN THE first two articles on the 'free' software that comes with Acorn's Z80 second processor we looked at the *Accountant* book-keeping program, *MemoPlan* (a word processor), *GraphPlan* (a spreadsheet) and *FilePlan* (an indexed data storage program). Now we'll consider the remaining packages in the bundle and summarise the whole Z80 package.

NUCLEUS

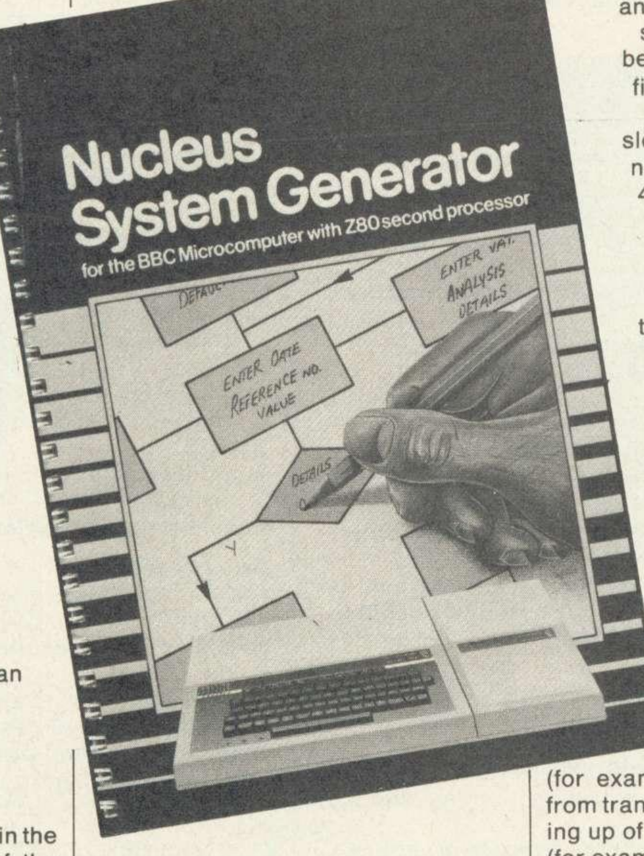
This is a system generator written by Compact Software International, which also wrote *Accountant* (see July issue). It is a program that creates computer programs based on a menu-driven question-and-answer session with the user. Its usefulness is based on the fact that a large proportion of the activities in many business applications are similar, differing only in the structure of the data being processed. These operations are data input (including validation); data viewing, including sorting and selection; and updating, particularly of master files such as ledgers and printing reports from the data, possibly combining information from more than one file. *Nucleus* can generate programs to do all these things.

Using Nucleus

The documentation for *Nucleus* is in the same house style as the rest of the packages and is again very good. It contains easy to follow step-by-step instructions on how to do the various operations and useful information on how to design your system. An example system – a school records system – is used to illustrate how to build up quite a useful set of programs. On-screen help is displayed as the operation continues, telling you what is going on and prompting you.

Like *Accountant*, the whole operation starts from the start-of-day disc. The program asks you for the date and then a program disc. This is the last you see of the start-of-day disc unless you need to restart the system.

Running *Nucleus* involves a lot of disc changing. Apart from the start-of-day disc there are three *Nucleus* discs – definition, reporting and parameter file – and discs for your created programs and data.



All I have space to do is summarise the operations required to set up a system.

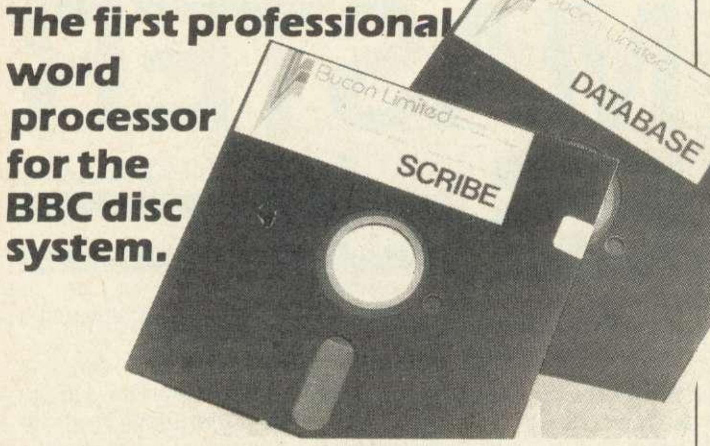
1. Create a parameter file if one does not already exist. This procedure need be done only once and indeed has already been done for you in this package.
2. Create a system definition. This has the name of the system and a system code (used for generating program names, etc).
3. Create file definitions. With this you indicate if it is a master file or a transaction file and enter details of each data field (name, length, type and so on). At this stage you also specify the key field or fields to be used for direct access to your file. Up to five key fields may be specified, but more than two slows down the processing time noticeably.
4. Create update program. You specify here the file and fields to be updated, and a data input screen is automatically generated. If you do not like the screen layout provided you can change it. While it is generating the program it shows on the screen the number of lines created so you can see that something is happening. A typical simple update program contained 130 lines and took just over a minute to generate.
5. Create file linkage. This is an optional feature but a powerful one. Two files may be linked via a key field to enable automatic updating of one from the other (for example, updating of master file from transaction file) or automatic picking up of data for validation or printing (for example, fetching a description for a code). Full explanations of how to design and implement linked files are in the manual.
6. Print file definitions. This option prints details of the file, including the generated file name – in case you want to do clever things with the data. It also prints a specification of all the fields, including their positions in the record.
7. Create master file print program. This and subsequent options are in the

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Move, copy and delete with affected text displayed in reverse video. Will move or copy within a page or to any other page in the document.
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- On screen underlining.
- Format line controls document width and allows setting of right and left margins.
- Tabs set on format line as required.
- Automatic centre and decimal tab.
- Text reformatting.
- Split page and dynamic page break display.
- Word count and display of cursor position by column & line number.
- Will use disc surfaces 0 to 3 as allowed by the BBC system.
- All disc filing operations menu driven, eg. re-name, copy, delete document, compact and catalogue disc, etc. No knowledge of the disc system required.
- Exec document — allows conversion of BASIC programs for editing by word processoı and then re-conversion back to either text or program files.
- File merge — one or more documents or other text files may be merged in sequence from any disc drive between 0 and 3.
- Automatic page numbering with page number insertion at any point on the page.
- Headers and footers.
- Total facility print module including selection of serial or parallel output, global printer control codes, page numbering offset, print from page to page, repeat print, etc.
- Selection of up to nine user definable keys for insertion of printer control codes into text, with up to five codes allocated to each key.
- Control number of page display lines for scroll speed increase.

The program comes attractively packaged in a simulated leather grain wallet which contains the manual, disc, chip & function key legend strip.

MERLIN DATABASE

Merlin Database is a database system designed exclusively for the BBC disc based computer. It provides for the structural input of text and numerical data which is stored permanently as a record on the computer. A group of records constitutes a database. Any number of databases may be created using Merlin Database.

Once created there are sophisticated facilities available for searching, selecting and drawing off information from the database by means of defining the search characteristics. This information can then be formatted for producing printed reports, lists etc.

Performance
- Maximum records per database 4000 • Maximum record size 1800 characters • Maximum no. of fields 32
- Maximum no. of characters for any single field 900
- Find any record in 2 seconds via key field access
- Search every character in a 100 kb database in 29 secs

Field Types
- Numeric — up to 9 digits • Date
- Sub fields for economic disc usage i.e. specify average & maximum field size

Data Search
- Search results directory held with database on disc
- Data can be passed to mail merge and report writer
- 16 level conditional search
- Search conditions include 'not', >, <, = .
- Wild card
- Database automatically sorted by key field
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Report Writing
- Database will integrate with Merlin Scribe word processor
- Format printer output with simple forms editor
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- Arithmetic calculations & accumulators
- Conditional report writing
- Semi programming facility for forms & report generation

Other Facilities
- Mail merge using Scribe • Conditional mail merge
- Automatic reformating of lines • Capable of conditional transfer of information between databases.

Database comes in chip with manual, simple fitting instructions & systems disc. Also planned is the production of Database integrated with the Merlin Scribe word processor in a single chip although the database is designed to integrate easily with Scribe in a separate chip.

MERLIN DATABASE £49.00
MERLIN SCRIBE £59.95
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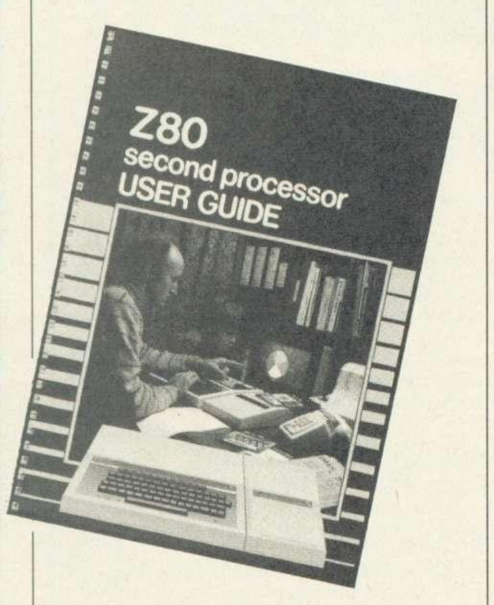


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reporting section of *Nucleus*. This gives a simple print of a master file.
8. Create selected report program. This gives you a more complex print of any file. You may specify headings, which fields are to be printed and any values to be computed. You may also select and/or sort your data records and create totals.
9. Label printing. This is a program for printing out labels from your files on continuous label paper. To allow for small variations in label printing paper you may specify width to the nearest tenth of an inch and height to the nearest sixth of an inch.
10. Standard letters. To generate a continuous run of standard letters from a file (say, for a mail shot) this is the program to use. It has its own simple wordprocessor to input the text of the letter and you indicate where the variable text from the file is to appear.
11. Document writer. This is similar to the standard letter option but instead of generating a letter for each record it generates a report with an inbuilt listing of the data incorporated. This is a rather complex routine and in the short time available to look at it I was not able to make it work fully. Careful study of the manual and a step-by-step approach should eventually give results.



Conclusion

The above brief summary is an indication of what you can do with *Nucleus*. As long as you don't require your system to do clever data manipulation, you should be able to design and implement a fairly complex system in a matter of days instead of the weeks or months it would take with traditional programming languages. It tends to become a bit fiddly at times with lots of 'Details OK (Y/N)' prompts to answer and lots of disc changes, so good quality discs with reinforced centres should be used. Having said that it is certainly possible for intelligent non-programmers to use it and it is a worthy addition to this bundle of software.



LANGUAGES

Two versions of Basic and CIS Cobol are provided. The two Basics are the Z80 version of BBC Basic and a 'Professional' Basic more like the traditional Basics that have been around for some time.

BBC Basic is virtually identical to that provided with your BBC micro. A small manual is provided giving the differences between them, the main one of course being that the built-in assembler is Z80 code rather than 6502. Other differences are to do with the CP/M operating environment. A utility program called *Dip* is provided to enable programs to be copied from DFS disc format to CP/M format. Also on the disc are the well-known 'Welcome' programs, which all worked like the originals.

Professional Basic is a 'run only' implementation. This means that there is no built-in editor for interactive development of a program. This Basic reads and executes Basic ASCII source code programs. The idea is that you take the ASCII files of existing business programs and, provided you can get them copied onto BBC discs, you can run them unchanged on the Z80 second processor. They can, of course, be edited using a wordprocessor such as *MemoPlan*, or new programs may be written in the same way.

Benchmarks on the two Basics and on 6502 BBC Basic were as follows:

Prime numbers to 5000 (Sieve method)
6502 48 secs
Z80 38 secs
Prof. 30 secs
PCW Benchmark No. 7.
6502 22 secs
Z80 17 secs
Prof. 15 secs

As BBC Basic is known to be fast, the fact that Professional Basic is even faster is quite impressive.

You are either a Cobol programmer or you are not. For the Cobol enthusiast this is a full implementation of this well-known version of Cobol, complete with 'Forms2' screen designer and 'Animator' debugging tool for stepping through your program. The retail price of this alone is way above the price of the Z80 second processor.

OVERALL CONCLUSIONS

The Z80 second processor runs the CP/M operating system, which is the standard for eight-bit micros. This potentially gives you access to the hundreds of application packages written for that system. All that is required is for the package to be made available on BBC disc format and for it to be configured for the BBC micro's screen and keyboard control sequences.

Most good packages have a configure program to achieve the latter. No doubt the software distributors are already working on this. In fact, Software Limited is promising 300 packages 'soon' (July issue, page 9). In the meantime Acorn has provided this free bundle of software. Many people will not need to buy any more, as there is something for everyone. In fact they are unlikely to find a use for all the software provided.



All of it is professionally written and documented and I rate it from good to excellent. I thoroughly recommend the Z80 second processor with all its free software to anyone with a BBC micro wishing to upgrade to a full business system. Indeed, it should be considered as a cost-effective way to obtain a business system even if you haven't already got a BBC machine. The main problem is the amount of desk space required as nothing can really stand on anything else.



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Both systems allow for 1000 to 10000 records per file depending on configuration and use, and initialise on shift-BREAK without user OS intervention. Fully documented source listings and optional user-modifiable VIEW text operating documentation are included on the master disc, and hard copy manuals are provided.

HMS BASIC ENVIRONMENT is specifically an aid to BASIC program development designed to encourage the creation of well-structured readable code in circumstances where memory becomes a constraint. Procedures to handle screen I/O, cursor switching, CLI invocation, and keyboard validation are provided, with a linking BASIC source-file compressor which includes variable name compression to two bytes. The ability to link as many BASIC source modules as desired into a single condensed running version resolves the coder's conflict between space and intelligibility; 60% compression is effected on our sources for the above accounts packages.

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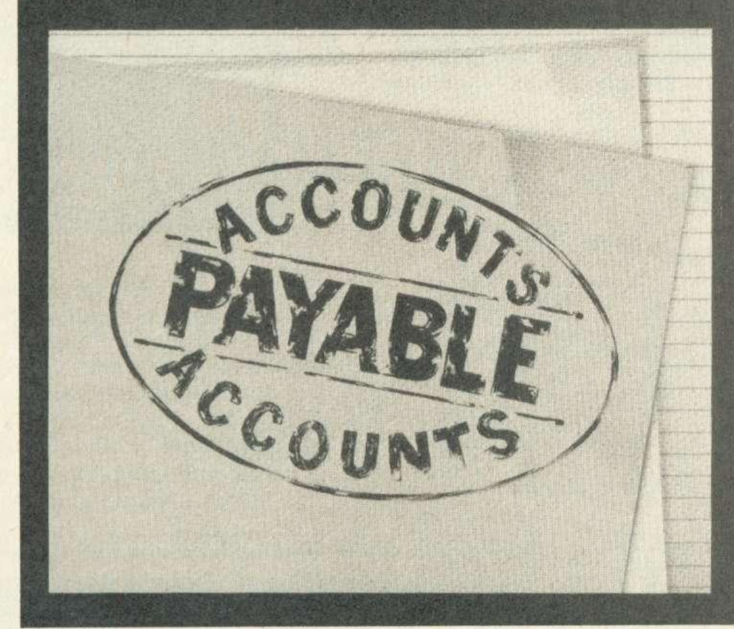
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LIVE LEDGERS

Paul Beverley rounds up the last of the Acornsoft business suite, the small company accounts packs

ACCOUNTS PAYABLE
Purpose – maintain the purchase ledger, analyse input VAT, produce remittance advices and creditor analyses

- Supplier Update
  - New Entries
  - Enquiry
  - Amendment
  - Deletion
  - List All Records
- Ledger Postings
  - Invoice Entry
  - Credit Note Entry
  - Adjustment Entry
- Remittance Advice

  This updates the purchase ledger and prints remittance advice notes to accompany payments
- VAT Analysis
- Account Analysis
  - Account Enquiry
  - Aged Creditor Analysis*
- Close Ledger

  This deletes from the purchase ledger all transactions (before a certain date) which balance at zero, thus cleaning up the ledger and saving file space

Figure 1. Sub-menus of the 'Accounts Payable' package, set out as headings and subheadings

'Accounts Payable' and 'Accounts Receivable', Acornsoft, £24.95 each (inc VAT)

ONE OF the difficulties of using micros for doing the accounts for a small business is that no two applications are alike. The solution would be an accounting system tailor-made for your business, but this would be too expensive for most small businesses, so we have to rely on off-the-shelf accounting packages.

The problem is, which one best suits your requirements? Writers of accounting packages have to avoid the extremes of having too many facilities, making the package slow, cumbersome or expensive, or not enough of them to give the package appeal to a large enough market.

These two Acornsoft programs have a wide range of facilities, but are not excessively expensive, though for most applications you will need both *Accounts Receivable* and *Accounts Payable* (if anyone knows of a business which only receives payments and does not have to make any, let me know!). So really you have to think of these two programs as making up a system costing virtually £50.

The other point to consider is whether you want just an accounting package or whether you also want some of the other facilities aimed at small businesses that Acornsoft has produced alongside the accounts packages. These include *Invoicing, Order Processing, Stock Control, Purchasing* and *Mailing List* (see reviews in the June issue). This present review does not extend to any of these modules, but the idea of the system as a whole is that you make use of common data files, so that as you add more customers or suppliers you need change only one file.

These are disc and printer based systems – you can't run them without having both. You could get away with a single disc but this would involve a lot of changing of discs since the system programs are held on a different disc from the data. It would be possible to put the data on the programs disc, but on a 100k drive it wouldn't leave much room for the data file – less than 20k, in fact.

When setting up your system, the first thing to do is put in your own business information, tell it which of the modules you are using and what sort of printer and disc system, and set up your data files for suppliers and/or customers. You then go in through a series of menus to the facility you want.

To give some idea of the facilities here are the menus available beyond the main menu of system set-up, listed as headings and sub-headings (figures 1 and 2).

As with much Acornsoft material, these packages are very professionally produced. I test software by deliberately trying to enter all the wrong responses I can, but at no point could I get

either of them to do anything wrong. The screen presentation is clear and, generally speaking, the speed response good, though I had only very small files to work.

The manuals are well set out and explain clearly what each function does and how to operate it, though most of the time the programs are self-documenting and tell you what inputs are necessary. Because the system as a whole covers so many different functions – invoicing, mailing and so on – the format for entering information on customers and suppliers is rather rigid and asks for information which you may not want to use. However, it does mean that if you decide later on that one of the other modules would be useful – say, invoicing – it's easy to build that module into your system.

This is a very professionally produced system, is very easy to use, and you get a lot of facilities for your money. If the other modules are as well produced as these then the more you buy, the better value for money you get.

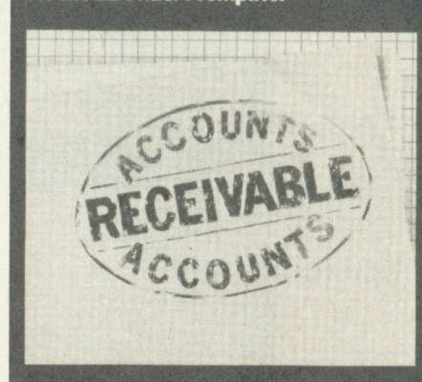
ACCOUNTS RECEIVABLE

Purpose – maintain sales ledger, analyse VAT, produce customer statements and debtor analyses

- Customer Update
  Sub menu as in 'Accounts Payable'
- Ledger Postings
  - Invoice Entry
  - Credit Note Entry
  - Amendment
  - Deletion
- Cash Allocation
  Posts payments to account, either 'open item' when payments are allocated to specific invoices or 'brought forward' when they are allocated to the latest invoice
  - Select Account Type (O/I or B/F)
  - Cash Allocation
- VAT Analysis
- Account Analysis
  - Account Enquiry
  - Customer Statements
  - Credit Limit Report
  - Aged Debtor Analysis*
- Close Ledger
  As 'Accounts Payable'

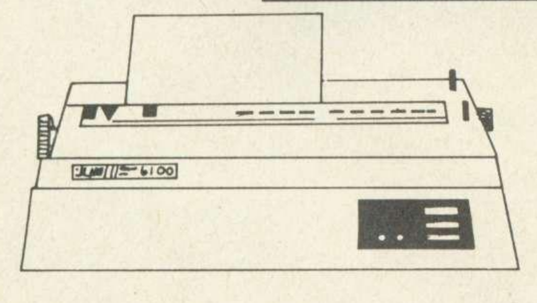
**Aged debtor and creditor analyses refer to unpaid invoices. What it means is that you get an analysis, either by week or by month, of all outstanding payments – ie, who has owed you what and for how long, or to whom you owe money and for how long you have owed it.*

Figure 2. Sub-menus of 'Accounts Receivable'

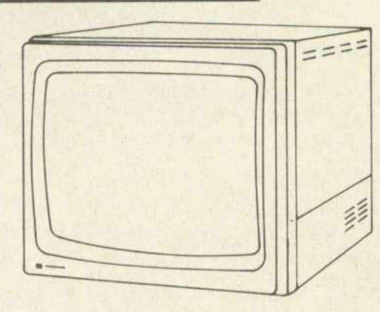


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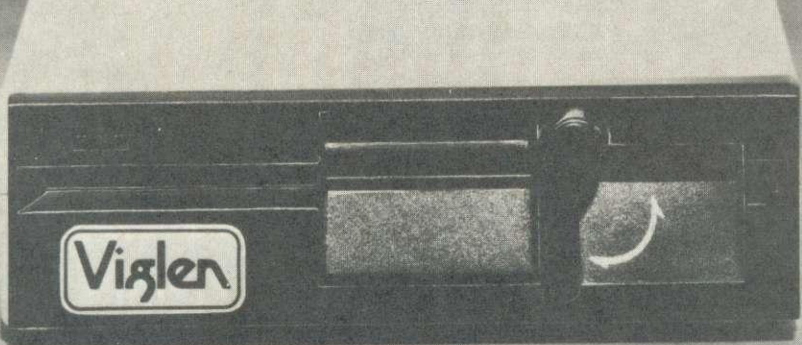
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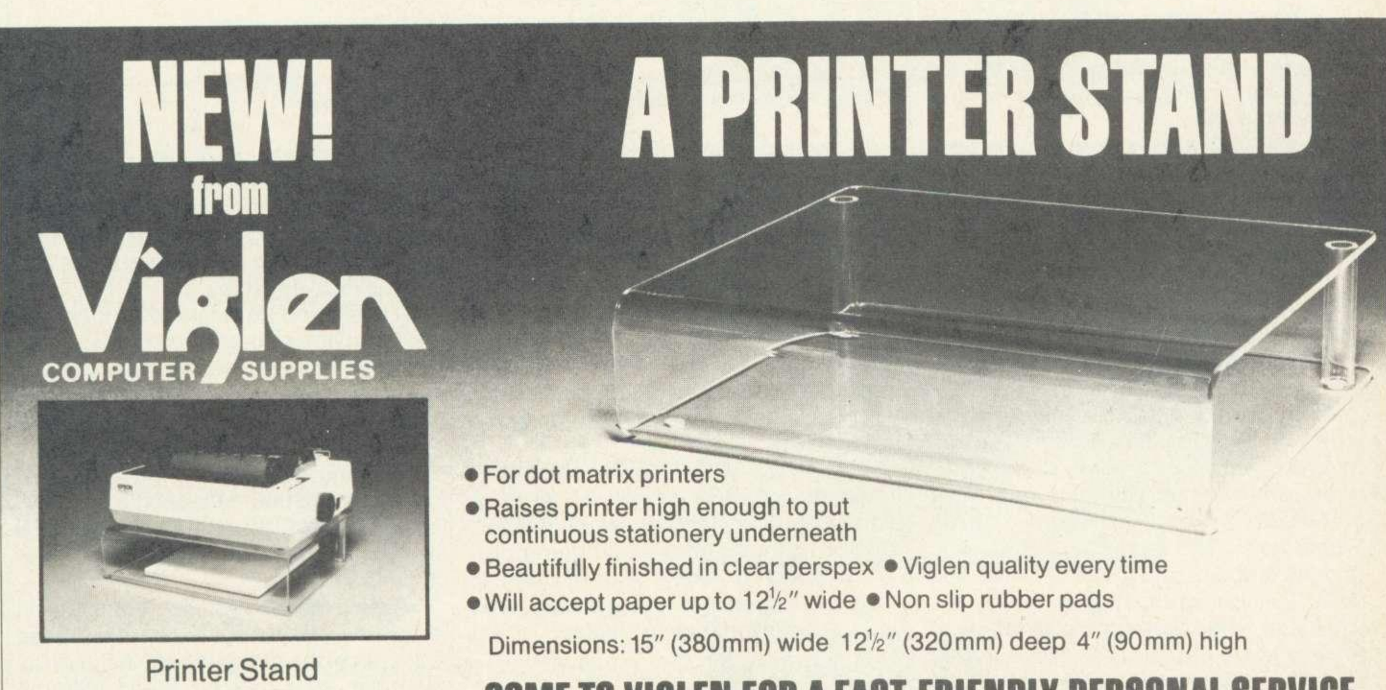
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SMART OPERATORS

Barry Pickles clears up the '?' and '!' confusion

A LETTER from reader Simon Fernie of London NW2 made me recall my first encounters with Acorn's Basic, and reminded me that among the most confusing things for a newcomer are the indirection operators – query (?) and pling (!). Matters are not helped by their description in the various manuals. '?' is described as 'a binary and unary operator, giving eight-bit indirection'. This kind of computerspeak seems designed to induce panic in the hearts of even experienced hackers but, once you get used to it you begin to appreciate the simple logic. OK, let's try and make some sense of it all.

Microsoft-type Basics have peek and poke. Peek allows you to examine the contents of a byte, while poke allows you to alter the contents. Those machines that think they are clever also have deek and doke, which peek and poke two consecutive bytes. As we shall see, all three Acorn computers go one better but, before reading the next paragraph, I suggest you get hold of something solid!

```
 5REM:  byte indirection
 10DIMA32; PRINT$12;@=0; DO
 20INPUT"TYPE YOUR NAME AND PRESS return"$A
 30IF LENA>32 PRINT"TOO LONG TRY AGAIN"'
 40UNTIL LENA<=32
 49REM: get vector for $A
 50C=?#33D*256+?#322
 60PRINT'"$A IS NOW STORED AND READS:"'$A''
 70PRINT"ITS LENGTH IS "LENA" CHARACTERS"''
 80PRINT"IT IS STORED FROM LOCATION #"&C''
 90GOSUBp
100PRINT"STORAGE IS AS FOLLOWS:"'
110GOSUBh
120X=0; DO
130PRINT" #"&C+X"      "
140IF A?X=32 PRINT$8"<SP>      ";GOTOa
150IF A?X=13 PRINT$8"<CR>"';GOTOb
160PRINT$(A?X)"          "
170aP."A?"X'
179REM: format
180bX=X+1; IF X%10=0 GOSUBp;GOSUBh
190UNTIL A?(X-1)=13
200PRINT"END OF $A - NEXT STRING WOULD BE"
210PRINT"STORED FROM #"&C+X'
220@=8;END
229REM: page & header
230pPRINT"PRESS return TO CONTINUE"'
240LIST#FFE3; PRINT$12; RETURN
250hPRINT"location character  element"';RETURN
```

Listing 1. Provides a graphic representation of string storage

The '?' and '!' operators of both Atom and BBC Basics are derived from BCPL (see *Acorn User*, April 1983) and are really a very efficient way of indirectly addressing sections of memory. The '?' operator works on single bytes (eight bits), while the '!' operator works on four bytes at a time (four bytes are known as a 'word', hence its definition 'word indirection').

Both '?' and '!' can perform *either* a peek or a poke, depending upon the context. (I did warn you!). If the operators are on the right-hand side of an expression, they are always taken to mean peek. The same applies to conditionals and connectives (IF, AND and OR). On the left-hand side of an expression, the operators are taken to mean poke. Thus, A=?32768 really means in Microsoft Basic A=PEEK (32768) and ?A=32 would be POKE A,32, while ?A=?B translates as POKE A,(PEEK(B)). It is absolutely vital that you understand this, or the rest of the article won't make any sense. Read this paragraph again if you're unsure – suck your thumb if it helps!

Right, now we've got the basics out of the way, let's deal with the 'indirection' bit. String variables can be of indeterminate length, so they are normally stored after the program text. To keep track of them, the base address (start) of the actual stored string is allocated to the string pointer storage area, in block-zero memory. Thus, for a variable called $A, the A actually holds a pointer to where the string really is – this is known as 'vectoring'. A string is a series of characters ending in a carriage return (#0D) so, to find $A, the Atom looks up the vector and then prints everything from that address as an ASCII character, until it finds a carriage return.

Let's look at a typical example. Imagine we have stored at #3000 a string, reading 'THIS IS AN EXAMPLE'. Now, if you used the ASCII dump program given in June's Atom Forum to look at that part of the memory, you would see the following display:

```
3000: T H I S I S
3008: A N E X A M P
3010: L E 0D .........
```

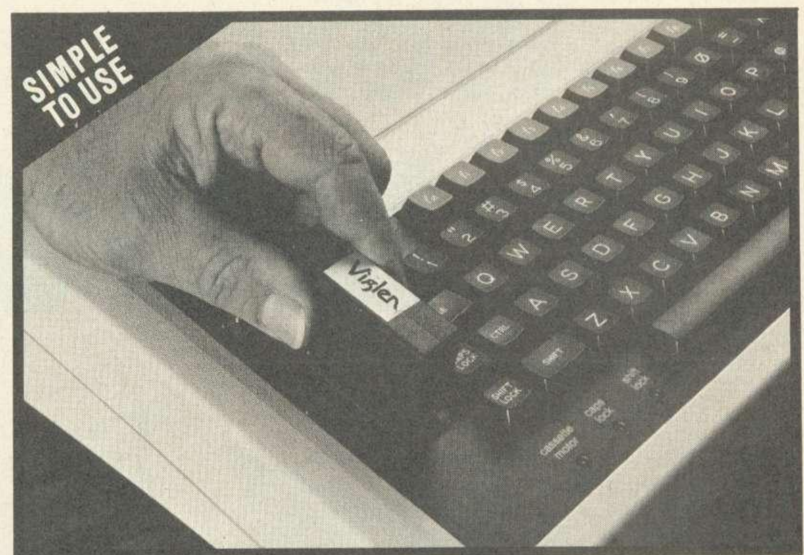
If you wanted to find the Nth character of this string, the formula would be ?#(3000+N−1) – the first character would be ?#(3000+0), the fourth character ?#(3000+3), and so on. This translates in Atom or BBC Basic to N?#3000 or #3000?N – it doesn't matter which way round you put it. Likewise, if you refer to $A instead of $#3000, you would say A?N (or N?A). This is known as 'string indirection'.

'Byte indirection' is really the same thing, but works on an array of numbers, whose values are less than 256 – see page 53 of the Atom manual – and these are commonly used for simple look-up tables.

To help you understand further, listing 1 provides a graphic representation of string storage. Once you understand indirection, the Atom's string manipulation routines become much clearer and you'll begin to appreciate why I believe them to represent a more logical approach than Microsoft's and BBC Basic's LEFT$, RIGHT$ and MID$ – A?N is much simpler to understand than MID$(A$,N,1).

Arrays of strings are handled in much the same way, but here the base address of the string is held in the array *element*. It is placed there using a 'dummy' string variable and assigning this with a statement of the form: AA(N)=A, where AA is the array, N the element and A the dummy variable. Once assigned, you can forget the dummy and use indirection on the array element as if it were a normal string (ie, $AA(N)) – see page 62 of the Atom manual for an example. Once you've mastered this, string sorts become much less of a problem, since you treat them as numeric sorts, using

page 130 ▶



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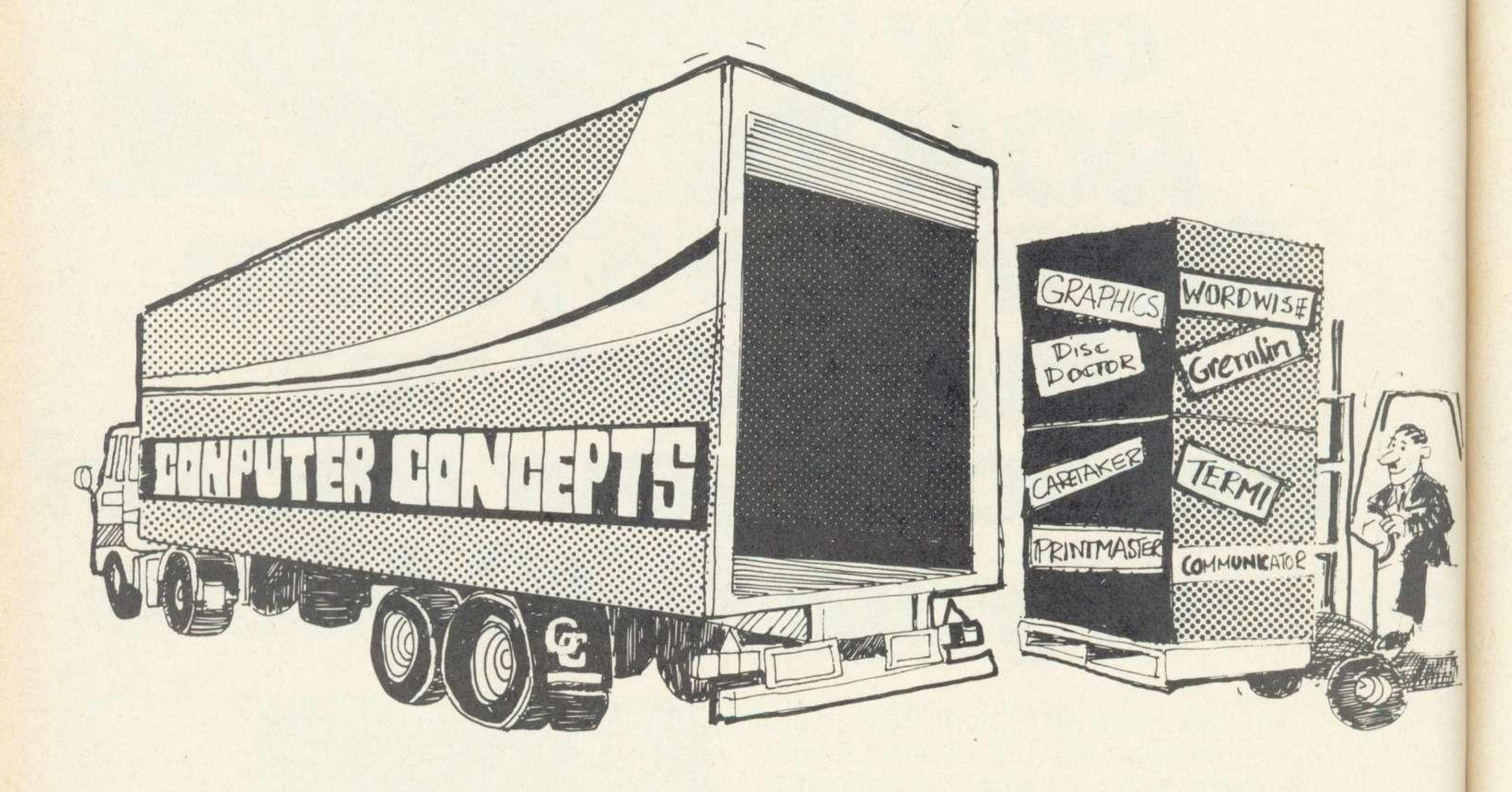
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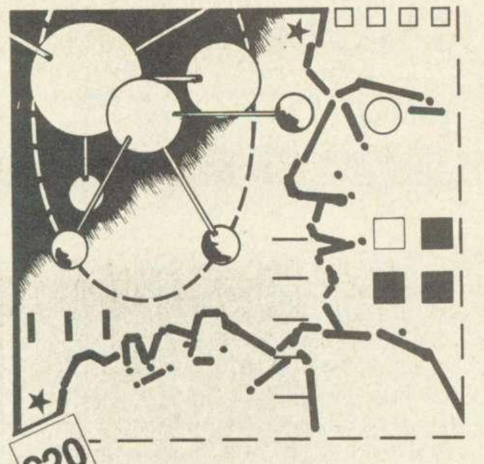
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Barry Pickles starts you off with printer dumps and readers' gems include routines for single stepping and a FILL command

£20 Base-2 text processor

AS PROMISED in last month's Atom Forum, here are screen dump routines for the Seikosha and Centronics 737/739 printers (listings 1 and 2).

```
 995REM: SCREEN DUMP FOR
 996REM: CENTRONICS 737/9
 997REM: by Barry Pickles
 998REM: (c)ACORN USER 1984
 999
1000dP.$21$2$27$37$48'
1010 A=160;S=32
1020 F.N=0 TO 1740 S.192
1030  F.J=0 TO 31;M=128
1040   F.K=0 TO 7
1050   X=#8000+N+J;D=32;P=1
1060    F.L=0 TO A S.S
1070    IF(X?L&M); D=D+P
1080    P=P+P;N.L
1090   P.$D;M=M/2;N.K
1100  N.J;P.';N.N
1110 P.$27$19$3$6;R.
```

Listing 1. Centronics 737/9 screen dump

While we are on the subject of printers, David Legg of South Godstone has supplied a simple but effective text processor (listing 3, yellow page xvi), which earns him £20. It was written for the Base-2 printer, and lines 136 and 137 select double and single spacing respectively. Likewise, line 345 selects elongated print. The appropriate code sequences for your printer should replace those in the above lines. Instructions are simple:

On running the program the menu is printed. New text is entered by typing 1. The computer will then ask for the required line length ('Enter number of characters per line'). The next question is Draft? This is specific for the Base-2 printer and so can be omitted. (On the Base-2 it will double-space.)

When all the questions have been answered an INPUT question mark will appear. Up to 64 characters may be entered. The program consolidates the text printing. Pressing RETURN enters the string and offers a new question mark. When a new line or paragraph is required type in ↑ (this will be omitted during printing). Note that lines 285 and 345 are specific for Base-2 printers. On entering ↑ elongated letters are printed. To return to the menu enter MNU on a new line then press RETURN.

LIST TEXT – The text is listed line by line by typing RETURN.

LIST TEXT + NO'S – The text is again listed by typing RETURN but also allows for alteration. Each line is printed with its line number. By typing A at the first query and pressing RETURN a new altered line can be entered. The new line is then printed out, so allowing two bites of the cherry.

The remaining functions are self-explanatory. On PRINT TEXT there is a delay while the text is being justified.

When loading from tape the normal requirement of waiting for the 'Leader' must take place.

£10 Single-stepping with VIA fitted

THIS submission from Andrew Luck, who wins £10, describes a means of single-stepping through a machine code program on an Atom equipped with a VIA (listing 4, page xvi). Link 2 must be fitted to enable interrupts from the VIA.

Timer 1 of the VIA is used in the one-shot mode to generate an interrupt after a set length of time. As the 6502 finishes executing the current instruction before responding to the interrupt, the timer must be set to interrupt the program during the next instruction. This causes the 6502 to branch to the interrupt service routine to display the contents of the registers. The target program must not contain SEI or BRK instructions as these would disable the single-step routine.

The set-up routine at KK0 is called instead of the target routine and this sets up the timer and clears the interrupt disable flag before executing an indirect jump to the target program, line 520. The IRQ vector at #204, #205 is set to point at the single step interrupt handler. When an interrupt occurs, the Atom stacks the accumulator before jumping to the interrupt routine. The interrupt routine displays the program counter, the contents of the status register and the A, X and Y registers. After waiting for a keypress, the timer is set running again and a return is made

Invented a routine or discovered a hardware modification for the Atom? Here's a chance to show your originality and win some cash. Send your idea to: Atom Forum, Acorn User, Redwood Publishing, 68 Long Acre, London WC2 9JH.

```
  5REM: SCREEN DUMP FOR
  6REM: SEIKOSHA PRINTERS
  7REM: by Barry Pickles
  8REM: (c) ACORN USER '84
 10 DIM LL10;Z=#FEFB
 20 IN."ASSEMBLE FROM"Q
 30 F.N=0 TO 10;LLN=Q;N.
 40 P.$21;F.N=0 TO 1
 50 P=Q;[
 60:LL0 LDA@2;JSR Z;LDA@8
 70     JSR Z;LDA@#7F
 80     STA#8A;STA#81
 90     LDA@#E0;STA#80
100     LDA@0;STA#8D
110     LDX@1;STX#8B
120:LL1 LDY@0;STY#89
130     LDA@27;JSR Z
140     LDA@16;JSR Z;LDA@0
150     JSR Z;LDA@#70;JSRZ
160     LDA#B002;ORA@8
170     STA#B002;LDA@#7F
180     AND#8A;JSR#FF10
190:LL2 LDX@7;CLC
200:LL3 LDA(#80),Y
210     STA#81,X;TYA
220     ADC@32;TAY;DEX
230     BNE LL3;LDY@8
240:LL4 LDX@7
250:LL5 ASL#81,X;RORA;DEX
260     BNE LL5;RORA;ORA#8B
270     AND#8A;JSR#FF10;DEY
280     BNE LL4;INC#89
290     LDY#89;CPY@32
300     BNE LL2;LDA@0
310     STA#8B;LDA@#7F
320     AND#8A;JSR Z
330     LDA#B002;AND@#F7
340     STA#B002;LDA@13
350     JSR Z;LDA@224;CLC
360     ADC#80;STA#80;LDA@0
370     ADC#81;STA#81
380     INC#8D;LDA#8D
390     CMP@27;BMI LL6
400     BNE LL7
410     LDA@63;STA#8A
420     LDA@32;STA#8B
430:LL6 JMP LL1
440:LL7 LDA@15;JSR Z
450     LDA@3;JSR Z;RTS;];N.
460@=0;P."*SAVE ""SCRNDUMP"""
470P.&Q"   "&P'
480P."LINK #"&LL0" TO USE"'
490END
```

Listing 2. Seikosha printers screen dump

to the target program.

Lines 70-160 set up the display, lines 180-200 display PC, lines 210-260 display P, and lines 270-290 display A, X and Y.

If the machine code is relocated, the address in line 40 of part 2 should be set to the end address of the m/c + 1. The address in line 50 should be set to the value of KK0.

Part 1 should be entered and run. Part 2 should then be entered in any convenient text space except #2800 and then run. The target routine should already be resident.

£20 Command for clearing, filling and inverting

The graphics commands in AtomBasic are fairly comprehensive, says Mark Bryson of Yealand Redmayne, Lancashire, in that they allow the use of absolute or relative plotting co-ordinates with clear, set or invert options in both point and line drawing, as well as move operations. Yet one facility often found on other machines that is not provided is the FILL 'area' command.

As listed the routine (listing 5) works properly only in the highest resolution graphics mode (CLEAR4), the reason being that enabling it to take account of the different resolutions makes the code significantly longer and more complicated, and anyway AtomBasic is usually fast enough at low resolution.

Information on how to use the point-plotting routine in ROM is given in the Atom manual (page 88). This routine plots points one at a time – although it does so rather quickly! The 'fill' routine works by calculating the changes to eight points (pixels) at once and then it uses part of the point plotting routine in ROM to actually put them on the screen. Incidentally, no screen interference will be seen during a 'fill', which is not the case when filling using plot or draw.

To make the programming easier Mark decided to dedicate certain variables to be used by the routine, rather than allow any to be used. Other variables could be used providing you alter the assembler program accordingly; in fact, any free bytes could be used, although this may mean you will find it less simple to assign values to the variables from Basic. Also if you use free locations in zero page RAM the relative jumps in the assembler will need to be reduced in size accordingly (or the code 'padded out' with NOPs).

The routine allows clearing, filling and inverting of all points in any rectangle, ranging in size from a single point (ie one pixel) to the whole screen. It uses but does not corrupt the least significant bytes of the variables L, T, R, B and I. These define the X and Y co-ordinates of the Left, Top (L, T) and Right, Bottom (R, B) corners of the rectangle to be filled, while I determines the effect produced.

There are six possibilities. Assigning to I a value of zero (or 3 to 127 inclusive) means that all points in the specified rectangle will be cleared, 1 sets and 2 inverts all points. By ORing these values of 1 with 128 a sort of half-intensity fill is possible. For example, I= 2⧅128 (equivalent to I=130) gives a half-intensity inversion of the defined rectangle. The half-intensity options work by affecting alternate points only, the remaining ones being left unchanged.

The code produced is less than 250 bytes long, which means that it fits neatly into the floating-point workspace at #2800. However it is re-locatable (even when assembled) as it contains no 'jump' instructions other than to an address in ROM, and so can be *LOADed to any position in RAM.

Two demonstration programs are included. These are called by typing 6.1000 or 6.2000. Finally, the routine included delays to avoid screen noise. If

Listing 5. Mark Bryson's FILL routine

```
2800   38 AD 33  3 ED 2D  3 B0
2808    1 60 AD 35  3 ED 23  3
2810   90 F7 A0  0 84 AE 84 AF
2818   A9 BF ED 23  3 90 EA A2
2820    3 4A 66 AF CA D0 FA  9
2828   80 85 A9 AD 33  3 48 4A
2830   4A 4A  5 AF 85 A8 68 29
2838    7 AA E8 98 38 6A CA D0
2840   FB 85 AD 38 A9 BF ED 35
2848    3 B0  1 98 A2  3 4A 66
2850   AE CA D0 FA  9 80 85 AB
2858   AD 2D  3 48 4A 4A 4A  5
2860   AE 85 AA 68 29  7 AA E8
2868   98 38 6A CA D0 FB  A 49
2870   FF 85 AC 38 A5 A8 E5 AA
2878   85 AE A5 A9 E5 AB A2  5
2880   4A 66 AE CA D0 FA A6 AE
2888   E8 86 AE 86 AF AD 2A  3
2890   29 7F 85 5E 98 2C 2A  3
2898   10  2  9 AA 49 FF 48 A5
28A0   AA 45 A8 29 1F D0  8 A5
28A8   AC 25 AD 85 AC 84 A9 A5
28B0   AA 85 5F A5 AB 85 60 18
28B8   68 10  1 38 2A 48 2C  2
28C0   B0 30 FB 25 AC 20 20 F7
28C8   18 A5 5F 69 20 85 5F A5
28D0   60 69  0 85 60 C6 AE D0
28D8   DF A5 A9 D0  2 68 60 A9
28E0   FF 85 AC E6 AA A5 AF 85
28E8   AE 29  1 F0 B2 18 68 10
28F0    1 38 2A 48 D0 A9  0  0

100P=£2800
105P.$21;[
110\check R>=L and T>=B
115SEC
120LDA£333;SBC£32D;BCSP+3;RTS
125LDA£335;SBC£323;BCCP-7
130\clear masks
135LDY@0;STY£AE;STY£AF
140\calc R,B byte
145LDA@191;SBC£323;BCCP-20
150LDX@3
155LSRA;ROR£AF;DEX;BNEP-4
160ORA@£80;STA£A9 high byte
165LDA£333;PHA
170LSRA;LSRA;LSRA
175ORA£AF;STA£A8 low byte
180PLA;AND@7;TAX;INX;TYA
185SEC;RORA;DEX;BNEP-3
190STA£AD
195\calc L,T byte
200SEC
205LDA@191;SBC£335;BCSP+3
210TYA;LDX@3
215LSRA;ROR£AE;DEX;BNEP-4
220ORA@£80;STA£AB high byte
225LDA£32D;PHA
230LSRA;LSRA;LSRA
235ORA£AE;STA£AA low byte
240PLA;AND@7;TAX;INX;TYA
245SEC;RORA;DEX;BNEP-3;ASLA
250EOR@255;STA£AC
255\calc no horiz. lines
260SEC
265LDA£A8;SBC£AA;STA£AE
270LDA£A9;SBC£AB;LDX@5
275LSRA;ROR£AE;DEX;BNEP-4
280LDX£AE;INX;STX£AE;STX£AF
285LDA£32A;AND@127;STA£5E
290TYA;BIT£32A;BPLP+4
295ORA@170;EOR@255;PHA
300\begin new column
305LDA£AA;EOR£A8;AND@31
310BNEP+10
315LDA£AC;AND£AD;STA£AC
320STY£A9 finish flag
325LDA£AA;STA£5F
330LDA£AB;STA£60
335\plot one byte
340CLC;PLA;BPLP+3;SEC
345ROLA;PHA
350BIT£B002;BMIP-3
355AND£AC;JSR£F720;CLC
360LDA£5F;ADC@32;STA£5F
365LDA£60;ADC@0 ;STA£60
370DEC£AE;BNEP-31
375LDA£A9;BNEP+4;PLA;RTS
380LDA@255;STA£AC;INC£AA
385LDA£AF;STA£AE;AND@1
390BEQP-76
395CLC;PLA;BPLP+3;SEC
400ROLA;PHA;
405BNEP-85
410]
415P.$6
999REM random rectangles
1000K=0
1010DO CLEAR4
1020 K=K:128
1030 FOR J=0 TO 99
1040  I=A.R.%3+K
1050  L=A.R.%128
1060  R=A.R.%128+L
1070  B=A.R.%96
1080  T=A.R.%96+B
1090  LINK£2800
1100 NEXT J
1110UNTIL 0
1120END
1999REM animation
2000CLEAR4;B=150;T=B+8;I=2
2010DO L=L-2;R=L+8
2030 LINK£2800;LINK£2800
2040UNTIL 0
2050END
```

```
 10REM     A   C   O   R   N
 20REM   MADE IN HOLLAND BY:
 30REM      ANDRE DE BRUIN
 40REM
 50 DIMAA100.BB100,CC100,DD100
 60 CLEAR4
 70a
 80 FOR O= 0 TO 3
 90   K=0;L=125
100   IFO=0;X=75;S=175;%S=(2*PI/13);R=6;V=4;
      F=0;H=50
110   IFO=1;X=65;S=185;%S=(2*PI/15);R=5;V=4;
      F=1;H=60
120   IFO=2;X=120 ;S=134;%S=1;R=2;V=2;F=0;H=0
130   IF O=3;X=0;S=14;%S=(2*PI)/7;R=5;V=1;F=0;
      H=0;L=188
140   FOR J = 1 TO R
150      B=S-X;GOSUB c; X=X+ %(H/R);S=S- %(H/R)
160   NEXT J
170 NEXT O
180 X=0;Y=0
190END
200c
210 IFO=0;Y= %(-0.04*((X-125)*(X-125)) +190 )
220 IFO=1;Y=%(( 4/360)*((X-125)*(X-125)))+40
230 IFO=2;IFJ=1;Y=40
240 IFO=2;IFJ=2;Y=20
250 IFO=3;Y=%((-10/4115)*((L-125)*(L-125))+19);
    L=L-20;S=S-1
260 T=((B/2)+L);U=Y; %R=0;Z=0
270o
280 P=%( COS%R*(B/2)+L); Q=%(SIN%R*((B/2)/V)+Y)
290 MOVE T,U;PLOT5,P,Q;T=P;U=Q
300 IF K%2 =0 THEN AAZ=P;BBZ=Q
310 IF K%2 <>0 THEN CCZ=P;DDZ=Q
320 IFK=0 THEN GOTO r
330 IF O=1 GOSUB n
340 MOVE AAZ,BBZ;PLOT5,CCZ,DDZ
350r %R=%R+%S;Z=Z+1
360 FIF %R<(2*PI+0.1);GOTO o
370 AAZ=AA1;BBZ=BB1;CCZ=CC1;DDZ=DD1;K=K+1
380RETURN
390n
400 IFK%2=0;MOVECCZ,DDZ;PLOT5,AAZ,BBZ;PLOT5,
    CC(Z+1),DD(Z+1)
410 IFK%2<>0;MOVEAAZ,BBZ;PLOT5,CCZ,DDZ;PLOT5,
    AA(Z+1),BB(Z+1)
420RETURN
```

Listing 6. Wire-frame acorn, wrought by André de Bruin of the Netherlands

this doesn't bother you, you can speed it up considerably by rewriting two lines as follows:

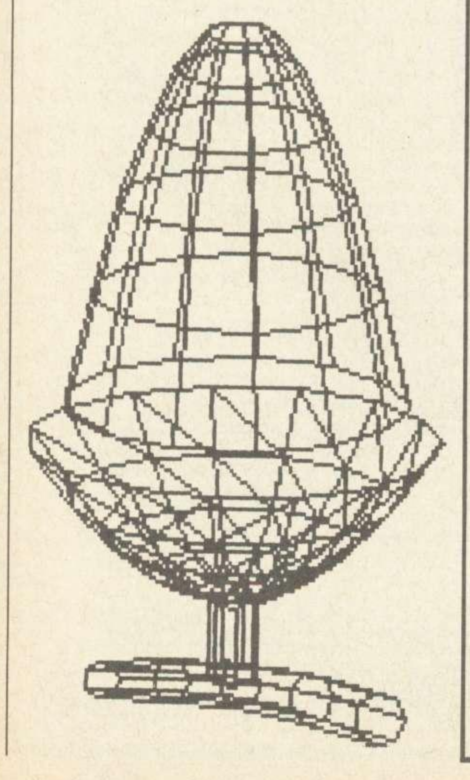
```
105P.$21;[;LDA#334; STA #80
350LDY #80;DEX; BNE P−1
```

Mark's reward for Atomfill is £20.

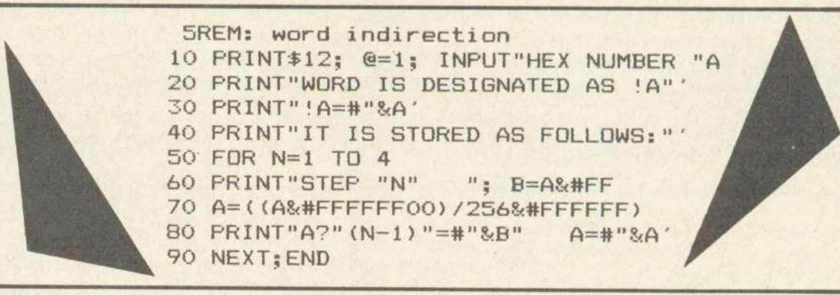


Dutch acorn

THE ACORN graphics routine (listing 6) is courtesy of André de Bruin of the Netherlands. It would convert easily to the Beeb if the X and Y co-ordinates are scaled up.



SMART OPERATORS



```
 5REM: word indirection
10 PRINT$12; @=1; INPUT"HEX NUMBER "A
20 PRINT"WORD IS DESIGNATED AS !A"'
30 PRINT"!A=#"&A'
40 PRINT"IT IS STORED AS FOLLOWS:"'
50 FOR N=1 TO 4
60 PRINT"STEP "N"    "; B=A&#FF
70 A=((A&#FFFFFF00)/256&#FFFFFF)
80 PRINT"A?"(N-1)"=#"&B"    A=#"&A'
90 NEXT;END
```

Listing 2. How the interpreter handles a sequence of numbers

◀ *page 124*

the ASCII value of the Nth character (obtained by for example A?N) – see June's *Acorn User* for some Basic sorting techniques.

Now let's return to simple numeric arrays and let's suppose that you want to store four (or more) consecutive numbers, from #3000 onwards. You could write:

A = #3000; A?0 = 255; A?1 = 254;
A?2 = 253; A?3 = 252

That's not only a lot of typing, it uses 45 bytes of program space (including line numbers and delimiters). If we convert each number to hex format, we can now write:

A = #3000; A!0 = #FCFDFEFF

This only uses 22 bytes and, what's more, it executes faster than the first method (almost four times faster). The more observant among you will have noticed that, in the conversion, the order of the numbers has become reversed. You must remember this when using word indirection. To see why this should be, listing 2 emulates the way the interpreter handles this statement. Word indirection is a fast and compact way of setting up long tables (eg for character generation). To illustrate its usefulness, try the following on the Atom, which clears a mode 4 screen to white:

F.N = #8000 TO #9800 S.4; !N = −1; N.

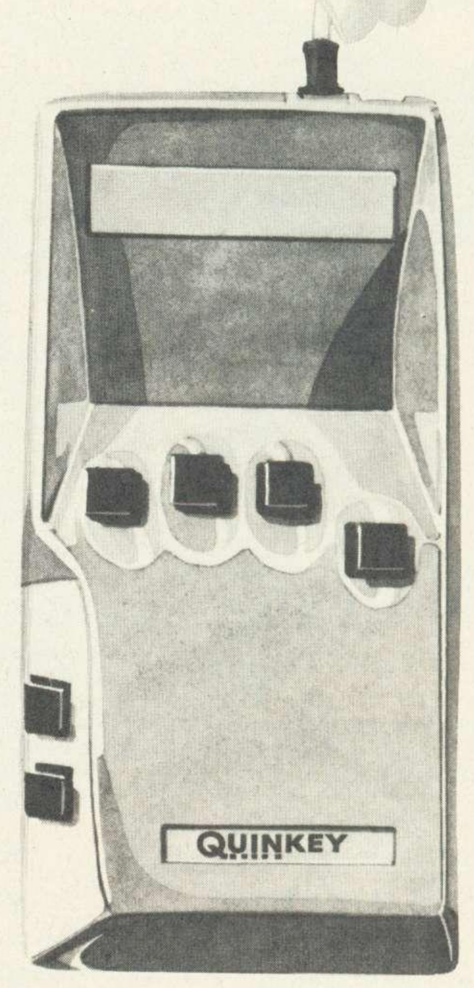
Then compare the speed with a similar routine, using the ? operator:

F.N = #8000 TO #9800; ?N = #FF; N.

You may have noticed that, instead of writing N!0 and N?0, we used !A and ?A. The Atom assumes the zero if no other subscript is given. You should also note that writing values using '!' *always* works on four bytes. If you use less, eg, !A = #FF3B, Atom will assume leading zeros and store it as 3BFF0000.

I hope I've now sorted out some of the confusion. These two operators are really powerful, once you get used to them, and Acorn must obviously agree, since it has been carried over into BBC Basic.

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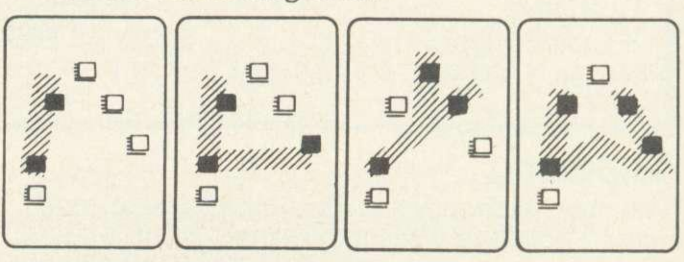
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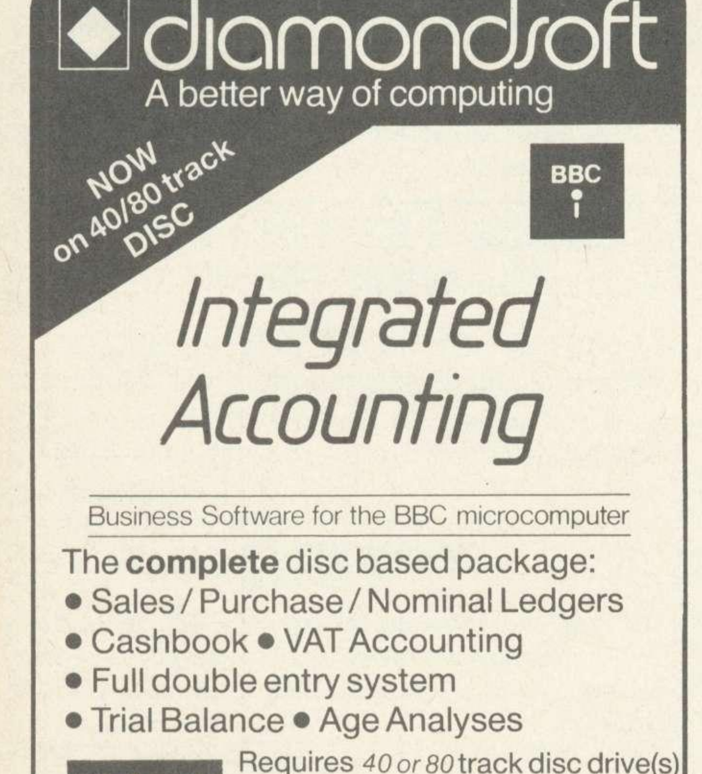
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SOFTWARE CHART

	TITLE	PUBLISHER	PRICE	MICRO	REVIEWED
1 (—)	Aviator	Acornsoft	£14.95 (£17.95)	B	May '84
2 (1)	Fortress	Amcom	£8.95	B	September '84
3 (—)	Blagger	Alligata	£7.95	B/E	
4 (12)	Battletank	Superior	£7.95	B	September '84
5 (5)	Twin-Kingdom Valley	Bug-Byte	£9.50	B	
6 (4)	White Knight II	BBCSoft	£10.00	B	January '84
7 (14)	Mr Wimpey	Ocean	£6.90	B	
8 (3)	737 Flight Simulator	Salamander	£9.95	B/E	December '83
9 (—)	Football Manager	Addictive	£7.95	B	
10 (—)	Overdrive	Superior	£7.95	B	September '84
11 (2)	Snooker	Visions	£7.95	B/E	
12 (6)	Dare Devil Denis	Visions	£7.95	B/E	July '84
13 (7)	Chukkie Egg	A&F	£7.95	B/E	September '84
14 (—)	Lords of Time	Level 9	£9.90	B	July '84
15 (13)	Hunchback	Superior	£7.95 (£11.95)	B	September '84
16 (re)	Killer Gorilla	Micro Power	£7.95	B/E	November '83
17 (10)	The Hobbit	Melbourne House	£14.95	B	
18 (9)	Cylon Attack	A&F	£7.95	B/E	April '84
19 (—)	JCB Digger	Acornsoft	£9.95 (£11.50)	B	June '84
20 (—)	Ghouls	Micro Power	£7.95	B	June '84

B = BBC E = Electron re = re-entry Prices in brackets are for disc version

BUBBLING UNDER

Mr Men (Mirrorsoft)
Jet-Power Jack (Micro Power) – reviewed July '84
Guardian (Alligata)
Sheepdog (Longman)
Confrontation (Lothlorien)

Compiled by RAM/Computer

ZOOM – straight up to number 1 goes *Aviator*, without even observing the formality last month of bubbling under – and we're sure it'll stay sky high for quite a while. Just as spectacular – because his arrival was more sudden – is the way Roger the Dodger, master burglier, has stolen his way into our chart in *Blagger*.

Otherwise things look quite stable, with *Fortress* only just slipping from number 1, the *Twin-Kingdom Valley* adventure level-pegging with last month and *White Knight* defending itself well at number 6. Flight simulator *737* is also enjoying a long run.

Five more new entries, too, but at only number 19 *JCB Digger* is making a shaky start to its progress up the list – it is, after all, nicknamed 'JCB Judder'. And *Ghouls* at number 20 isn't proving as spine-tingling as its name suggests. *Lords of Time* has warped in at number 14 and Sue Gazzard's witty, fast and ingenious concoction deserves to climb high.

Even out of season, *Football Manager* has shot into the premier league, closely pursued by *Overdrive*. Superior's car chase game, though, is surely too straightforward to stay the distance (review page 157). If you don't already know, find out in this issue why *Cylon Attack* and *Chukkie Egg* have been such tenacious middle-rankers.

Bubbling Under features some almost-unknowns, but perhaps most interesting is one that isn't there at all: Aadvark's *Frak!* The game, named after the bubble captions its hero produces, uses some lovely sprite graphics centring on a caveman and his handy yo-yo. Look out for it! (review page 155).



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UNICORN: CHEAPEST ROUTE TO UNIX

Andrew Cummins and Peter Voke test Torch's 16-bitter

THE Unicorn system from Torch is a good deal more expensive than other second processer systems, but it gives you something special for your money. The system given for review contained a 68000 (16-bit) second processor with a quarter megabyte of RAM (256k), a Z80 processor with 64k of RAM, a 20Mb hard disc drive, and a single 5¼in floppy drive with a slimline profile, similar to one you may already have connected to your BBC micro, storing up to 400k. The whole package sat in a buff-coloured box that stood on one of its ends beside the BBC micro, looking rather like a squat tower 7½in wide, 10½in deep and 12½in high.

It had to be connected to the BBC micro not only via the Tube, but also through the 1MHz bus (for the hard disc) and the disc drive port (for the floppy). This took about 20 minutes to sort out, and left the squat tower of the Unicorn a few inches from the right hand side of the BBC – close, but not so close as to interfere with typing. The fan in the Unicorn was pleasantly quiet; it was a while before we noticed it at all.

Normally, on receiving a Unicorn system the user would have to load the main utilities (CPN, Perfect software, and Unix – more on these later) from the dozen or so floppy discs. This exercise might well take a day if you encountered problems, but fortunately we were spared the exercise: Torch had already loaded up the hard disc with everything. Once that is done, it should not need to be repeated, short of disaster. The only other thing to be done is to put a ROM in the BBC micro in one of the spare slots. Then you are ready to go.



A Unix combination: monitor, Beeb and Unicorn box containing 68000 second processor, Z80 processor, 20Mb hard disc drive and 5¼in floppy drive

First impressions of using the Unicorn revealed some good, some bad features. We were using a colour monitor and found the mode 1 80-column display the best to use. This would not have been acceptable on a TV, so a monitor is really necessary, preferably a good resolution monochrome monitor – you are unlikely to need colour. It is in fact quite easy to issue instructions to the BBC (which is acting here as a front-end processor, chief cook and bottle-washer to the 68000) from within the CPN environment, to change the screen background colour, mode or anything else.

Less satisfactory was the way that the Unicorn ignored several obvious special features of the BBC micro. For instance, the ESCAPE key was not used, as it clearly should be, to generate the normal escape code of Unix (^C).

More serious was the fact that the BREAK key was left in normal operation. It is difficult to make sure that pressing the BREAK key leaves all processors and disc drives in a reasonable condition: difficult, but not impossible. In our opinion it should have been done. The Unicorn, like all Unix systems, is constantly swapping data in and out of disc, and pressing BREAK as often as not left the hard disc corrupted.

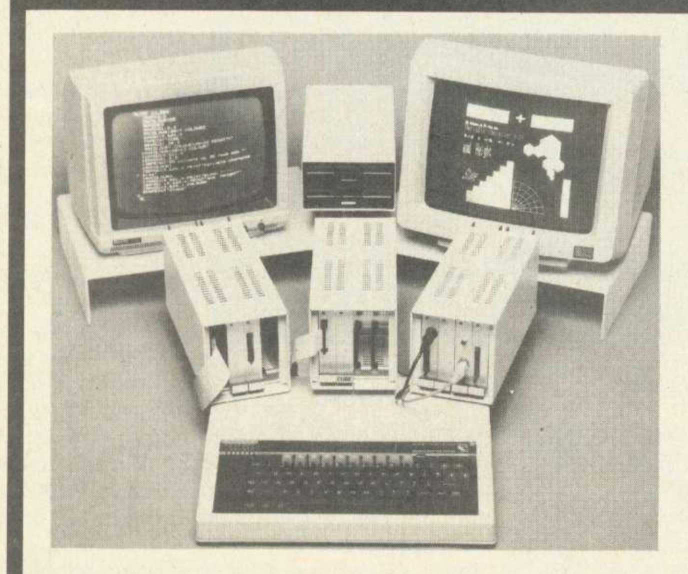
Paging mode (CTRL-N) was switched off, and could not be changed. Small points like this, making use of the best features of the BBC micro, could make the difference between the Unicorn being a joy to use and being frankly annoying.

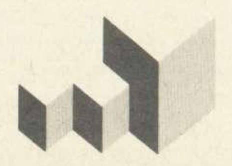
Once the Unicorn is connected and working, the user is interacting with the CPN operating system running on the Z80. To anyone familiar with CP/M 2.2 this will not bring many surprises. All the utilities you would expect are there. We found this part of the system easy to use and the documentation first-class.

Supplied to run under CPN is a package of integrated business applications programs under the Perfect label. There are three programs, the *Perfect-Writer* wordprocessor, *Perfect-Calc* spreadsheet, and *Perfect-Filer* database program. These have a standard command structure and interworkable files, as you would expect of a properly integrated package. *Perfect-Writer* and *Perfect-Calc* are both quite adequate, the wordprocessor being analogous to *Wordstar* but including a spelling checker and mail-merge facilities. *Perfect-Filer* is a fairly simple database program.

Documentation was again excellent with tutorials available on-screen if required.

The command inputs and printer drivers were configurable, but there was no real evidence that the packages had been tailored to use any features of the BBC microcomputer: it was





really just acting as a CPN terminal.

The main feature of the Unicorn is its low-cost approach to providing Unix. If you have a BBC micro and want CP/M plus applications software, you will probably get a second processor from Acorn or elsewhere. The person who buys the Unicorn is paying a lot more and is presumably looking for more, namely the Unix programming environment.

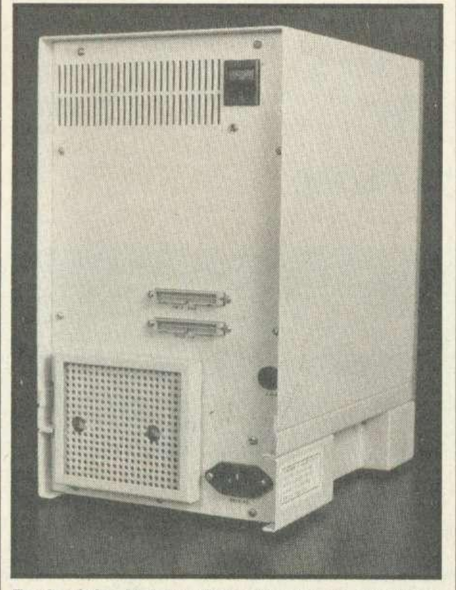
For those unfamiliar with Unix, it will be useful to give some idea of what it is (or should be) and what it does. Unix is not just another operating system (like CP/M) or even a super-operating system. Originally designed in 1969 as a multi-user scheduling program or time-sharing system, it has come to include so many powerful tools and utilities that it is probably the programming environment *par excellence*: not so much a system, more a way of life. The only comparable environment I've come across is the Structured Programming Facility now available on IBM and Amdahl mainframes.

Unix, however, has been around a lot longer than SPF, and, because its 'kernel' is written in the high-level language C, it has spread rapidly to every level and type of computer. Anyone who can provide a C compiler and some machine-specific routines to handle disc drives, I/O and so on can put Unix on their machine. Now it is becoming available on microcomputers. In ten years' time, the megabyte micros we all hope to have will almost certainly provide Unix or a descendant of it.

What does it do? A good Unix system should provide compilers/interpreters for all the well-known languages: Pascal, Basic, Fortran, Cobol, C (of course) and perhaps more specialised languages such as Lisp. It gives the user a convenient hierarchical file structure that keeps his files separate from those of other users, protecting access by means of passwords. It provides a large number of utility programs – usually several hundred in all – that can be called up by a simple command from the keyboard. And the commands in turn can be combined or altered by the user at will, to create new commands to his own specification.

The people who created and developed Unix were programmers. They wanted the kind of power that normal operating systems, then and now, have a habit of denying programmers – who, after all, are the ones who actually use operating systems. If you've ever looked up something in a manual, found you can't do it, and said to yourself 'Why not?', then Unix was made for you.

The result is that Unix is very flexible, very powerful, rather complex, and potentially dangerous. For instance, the commands tend to be terse, that is, short two or three-letter abbreviations. This makes Unix somewhat more difficult to learn than your average microcomputer Basic, but less frustrating to use once one is adept. The whole Unix system is now sufficiently complex for even an experienced user to overlook the best way of doing something, or simply do it wrong. Unix is not really a system for the beginner in computing or the business person with a smattering of computer literacy. It is a programmer's tool, not an executive toy. Unix is like a blunderbuss in that it is easy to shoot yourself in the foot unless you are careful. If you know what you are doing, it will help you to lick programming problems faster than you ever knew you could.



Back of the Unicorn box showing connections to 1MHz bus and disc interface, with power switch (top) and cable connection (bottom right)

Just to give a taste, here are some of the utilities available on the Torch Unicorn Unix, and any other decent Unix system. You have the choice of several editors including 'ed', which is fairly simple, and 'vi', which is, if anything, too powerful. You have 'sed', a search-and-replace editor.

The number of file manipulation programs is enormous. You even have programs that allow you to create your own computer language and compile programs in it, as well as being able to run programs in any of the existing common languages. You can create your own commands, either by combining existing commands or from scratch, using C. There is 'nroff', a text formatter, and 'sccs', designed for software project control.

You have full control over your filing system, I/O, and the destination of the output from any process. Fundamental to Unix, in fact, is the idea of stringing programs together so that the output of one becomes the input of the next; the implications of this in text-processing applications are mind-boggling.

You can set up one program to run in the background while you get on with something else. If you don't like the command structure ('shell', in Unix jargon) you are working in, pick another – or create your own. Unix is all about freedom and power, breaking down barriers to what you want to do rather than creating them, as other more limited operating systems frequently seem to do.

It all sounds wonderful, and indeed it is. People who get to know Unix well usually have nothing but praise for its power and flexibility, and if you are already a Unix user you will probably not need convincing.

The Unicorn, however, is a rather special implementation of Unix. If you already own a BBC micro with disc interface and high-resolution monitor, it will be the cheapest way of getting hold of Unix. Even if you don't own a Beeb it is still a cheap route to Unix. The problem is that, to some extent, you only get what you pay for. The power of Unix carries a cost, in terms of memory requirements and speed, that the Unicorn is barely capable of meeting.

Unix is entered from CPN by typing 'unix'. There follows a long logging-in sequence, in which the first big disadvantage of running Unix on the Unicorn becomes quickly apparent. Everything takes much longer than one is used to on bigger machines (or with less ambitious systems on smaller ones), even though only one person at a time can use the Unicorn.

The reason for the slowness is partly that the system I was given had 'only' 256k of RAM for the 68000 to use, and upgrades to 512k or 1Mb (available towards the end of this year, according to Torch) would allow easier caching of the hard disc transfers. However, another feature of the design is also fundamentally responsible for the slowness; the hard disc (and the floppy too) are not controlled directly by either the Z80 or 68000 processors within the Unicorn box. Instead they are connected separately to the BBC micro through the 1MHz bus and the disc port respectively.

In the case of the hard disc, this presents a severe bottleneck for transfers from the disc to the Unicorn processors. All data has to go via the 1MHz expansion port, through the 6502 in the BBC micro and back out along the Tube to the 68000. This convoluted journey is

page 165 ▶

QUINKEY FINGERS

Peter Voke lays a hand on the new Microwriter add-on for the Beeb

A SURPRISING new hardware add-on for the BBC micro has appeared. The Quinkey is a one-handed keyboard produced by Microwriter that provides a novel way of accessing the computer. It costs a little under £50, including VAT.

The Microwriter, from which the Quinkey is derived, was invented by a film director, and is reputed to have been used to write the film *Zulu Dawn*. That may not strike everyone as much of a recommendation, but the Microwriter has survived, and flourishes. Basically a portable text-recording device, in the Quinkey it has found a new and potentially revolutionary application as a plug-in keyboard for the Beeb. Versions are likely to follow for the Electron, the Spectrum, and the Commodore 64.

What is special about the Quinkey? First, in place of the conventional typewriter keyboard there's a specially shaped block about the size of a paperback book, with just six keys on it. Five of these six keys lie naturally under the fingers and thumb of the right hand, while the sixth is reached by a slight downward movement of the thumb. On starting to use the Quinkey the naturalness of the position of one's hand compared to a conventional keyboard is immediately apparent – and one can sit back in an easy chair with the Quinkey on one knee, rather than having to hunch over the keyboard in the usual hacker's style. Microwriter has been sensible enough to give the Quinkey a long lead.

So, one up for the Quinkey: no more backache. The next test is whether it does what it is supposed to do. The letters of the alphabet are entered by pressing combinations of fingers on the right hand, as a pianist plays chords, rather than one key at a time. This might sound more complicated than typing, but you quickly discover that the claims of Microwriter are no exaggeration: the finger combinations have been chosen to seem so natural that it takes only a few minutes – literally – to remember all the shapes for a to z. I didn't believe this claim until I tried it myself, but only needed to go back to the manual once to check a few letters a second time.

To cope with the BBC control codes (things like CTRL-U and CTRL-N) the Microwriter scheme has been extended in a simple way, and one presses a special 'shape' with one's fingers (COM-X) followed by the letter concerned. Yet another special shape (COM-H) allows the Quinkey to mimic the red function keys on the BBC micro, and a few non-standard characters



Microwriter's Quinkey, a 'complete alternative keyboard' for the BBC micro at £49.95

such as # and >. It might seem impossible to remember all the finger combinations involved, but once the basic 26 letters and five common punctuation marks are learned, the rest comes fairly naturally.

Microwriter claims that people take to the Quinkey-style keyboard much quicker than to a qwerty typewriter layout. A typing speed of 25 words per minute is reached faster, though it is difficult to get beyond 40 or 45 words per minute because of the one-handed nature of the action. This is likely to bother only the superfast professional typist, who can get up to 90 words per minute on a qwerty keyboard, and is not really a limitation for the micro user. Having used a Quinkey for a couple of hours, I am convinced Microwriter is correct.

The Quinkey arrives from Vector Marketing in a good solid polystyrene pack, with a separate interface pack. The latter contains a user's guide that is exceptionally clear and complete, with a useful technical section at the back. (One or two small points: the use of the thumb key alone for the space character is not dealt with properly along with the other main letters, and numeric-X actually produces an asterisk, not a letter X.)

In addition you get a small adapter, which plugs into the back of the microcomputer, allowing four Quinkeys to access the computer simultaneously. I had only one Quinkey and so cannot comment on the practicality of up to four people using the computer simultaneously.

To use the Quinkey you obviously have to program the Beeb to accept its input, and Microwriter provides two programs on tape to do this. One, called *Prog*, is for ordinary use in programming, or in programs designed to use the Quinkey input, and the other called *WP*, is for use with wordprocessors. The Quinkey works with either *Wordwise* or *View*.

In addition, the tape has a tutor program which some people may like to use, although it isn't really needed to learn to use the Quinkey.

When the *Prog* is run, it relocates some machine code of length &300 bytes to just above PAGE, and shifts PAGE up by &300. You now have a situation rather like that produced by an extra ROM that uses private workspace. The three pages you have lost are occupied in this case by the software that reads the Quinkey keyboard.

What happens is that the 100Hz interrupt from the system VIA is intercepted through IRQ2V and redirected to the Quinkey software. This technical mumbo-jumbo boils down to some-

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thing very simple: the BBC micro checks the analogue input a hundred times a second to see if you are doing anything with the Quinkey keyboard. If you are, it updates its 'current key press' and then, when you release the keys completely, puts the character into the input buffer.

One thing to note: the character is input when you release the keys, not before. This is slightly disconcerting at first, but makes sense, since it means that the keys you want pressed don't all have to all go down or spring up together. If they did, using a Quinkey or Microwriter would be impossible.

Taking a look at the machine code that runs the Quinkey, it turns out to be fairly simple but efficient. No workspace is used outside the 3/4k of Quinkey private workspace. You can adjust the action of the Quinkey in a number of ways, simply by knowing a little about what is going on in those three pages. So, for the benefit of present and future Quinkey owners, here are some hints.

First, the characters output by the Quinkey are held in lookup tables, 32 at a time. If *Prog* is loaded at &1900 (set PAGE=&1900 and LOAD 'PROG'), the data tables for all the characters lie between &1C4C and &1D0A. Locations &1C4C to &1C6B contain the ordinary lower-case letters plus the five common punctuation marks produced by the unshifted Quinkey. The Quinkey 'command' codes are in memory from &1C6C to &1C8B (though it is noticeable that the second 16 bytes are all zero, meaning that key presses involving both the thumb keys produce nothing). From &1C8C to &1CAB the capitals are stored, from &1CAC to &1CCB the Quinkey 'numeric shift' characters, and from &1CCC to &1CEB the 'special shift' characters introduced to cope with the BBC function keys and non-standard characters. The BBC control codes (ASCII 01 to 26) follow from &1CEC to &1D0B.

Of course, the characters are not in alphabetical order in these blocks. The position of the characters in the tables determines which character appears on the screen for a particular combination of keys pressed. The five fingers of the right hand each trigger one bit of a five-bit number. For instance, the Quinkey finger shape for the letter 'j' is thumb, ring finger and little finger. The five bit number is therefore 10011, or 19. The Quinkey produces a 'j' in response to this because a 'j' is at position 19 in the table beginning at &1C4C. The little finger alone is the letter 'u', and 'u' is the first letter in the table, as we expect. The whole table from &1C4C contains:

usgoqnbevt,a-.m hkjczyxilrwd'fp

in the form of ASCII codes.

This should allow you to reprogram the Quinkey without difficulty. For instance, to swap the Quinkey finger presses for 'u' and 's', you just swap their positions in the table, putting the ASCII code for 's' (&73) into &1C4C, and the code for 'u' (&75) into &1C4D. It makes more sense to do something useful, like putting the SHIFT+function key codes into unused spaces in the tables: in my personalised version of *Prog* I have put &92, &93, &95 and &96 into locations &1C7C, &1C7D, &1C7F and &1C83 respectively. The Quinkey then produces the teletext colour characters for green, yellow, magenta and cyan when two thumb keys are pressed with one other key.



Four Quinkeys can access the Beeb simultaneously

One major way in which the Quinkey differs from the ordinary keyboard is in its handling of autorepeat. Because a character is put into the buffer only when the finger keys are released, no autorepeat takes place when the keys are held down. (If you are not sure what 'autorepeat' means compare this with the action of the BBC micro when you put your finger on a key and keep it there.)

A simulation of autorepeat has been put into the Quinkey, however, which works like this: if, after entering a character, all the keys are pressed including both thumb keys, the character last entered starts to autorepeat at about the normal default rate used on the main keyboard (5/100 second). This rate is not affected by *FX12 but can be altered by changing a byte in the Quinkey driver machine code at &1AAC. This is normally 5 (the second byte of LDA #5) but can be changed to 2 or 3 for a faster autorepeat.

The only keys that need to autorepeat on a regular basis are the four cursor keys, Copy, and perhaps Delete. I feel it would be nice if these keypresses, all of which are Quinkey 'command' shapes, could autorepeat just by holding them down for more than one-third of a second or so, at a controllable rate. Since the actual handling of the Quinkey input is done entirely by software, it is likely that improvements and enhancements like these (if such they are) will become available in due course.

One keyboard facility the Quinkey cannot mimic is the INKEY(-N) statement in Basic, or the equivalent OSBYTE call in machine code. These access the hardware connected to the keyboard rather than the input buffer, and cannot be intercepted through RDCHV: possibly they could be intercepted through BYTEV.

This is not a great problem so long as the Quinkey is considered a text input device rather than a games controller halfway between a keyboard and a joystick. However, I'm sufficiently enthusiastic about the Quinkey after a week of use to think that Microwriter can afford to set its sights as high as possible. It is conceivable, with advances in Very Large Scale Integration continuing, and tiny flat-screen TVs starting to make their appearance, that portable computers in ten years will be no larger than the Quinkey itself – and that is all you will need. If this prediction turns out to be true, the six-button keyboard is the interface of the future, and could be the death of qwerty sooner than anyone expects. Before that happens, we are likely to see Quinkeys linked to the computer by infra-red rather than wires, like the IBM PC keyboard.

Because the Quinkey has not been programmed to intercept INKEY with a negative argument, one popular feature of the BBC micro does not work from it. This is the use of the SHIFT key in scrolling listings in paged mode. Paged mode can still be switched on and off, since CTRL-N and CTRL-O are both characters the Quinkey can output. But once you are in paged mode, you have to press the SHIFT key on the keyboard to keep a listing going.

For a programmer (Basic or assembly language) this is a real disadvantage. The problem that the Quinkey is up against is that it really has to provide all the functions of the keyboard, without exception, if it is going to compete. It comes so close that it's a pity Microwriter didn't make sure of the paging facility at least.

You will probably expect me to finish by saying this article was typed using a Quinkey. It wasn't. I'm still a lot faster on the keyboard, and possibly always will be. Old habits are hard to kill. But I'm going to persevere with the Quinkey, if only to avoid developing the dreaded Hacker's Shoulder in my old age. And to be ready for the hand-held supermicros of the 1990s, of course.

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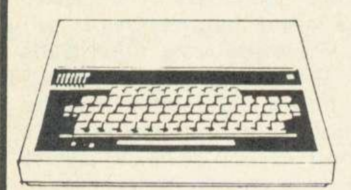
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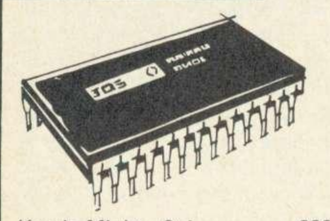
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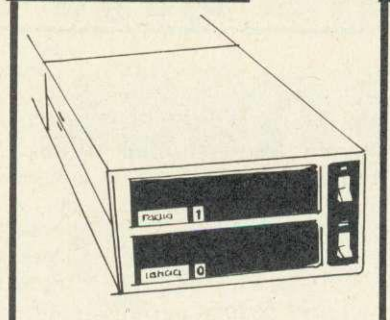
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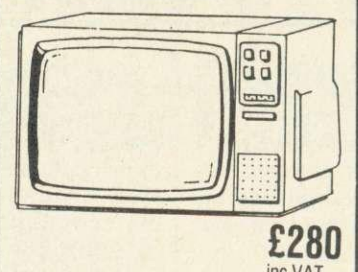


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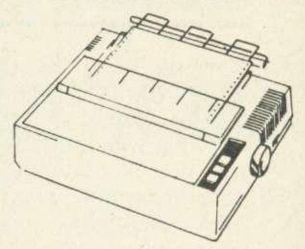
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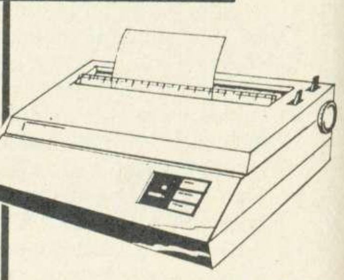
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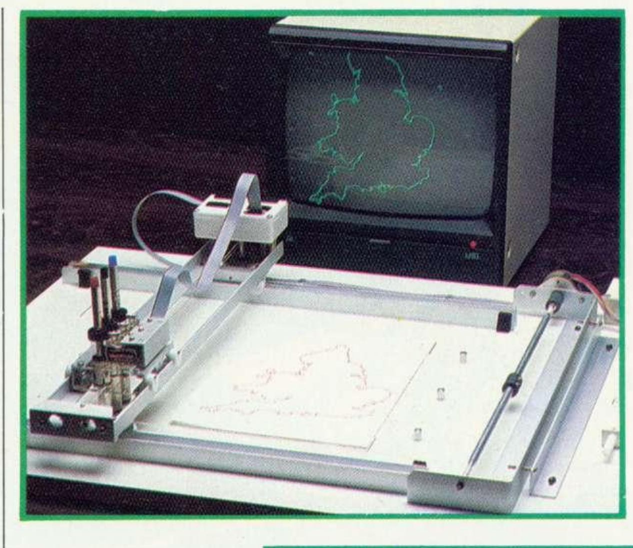
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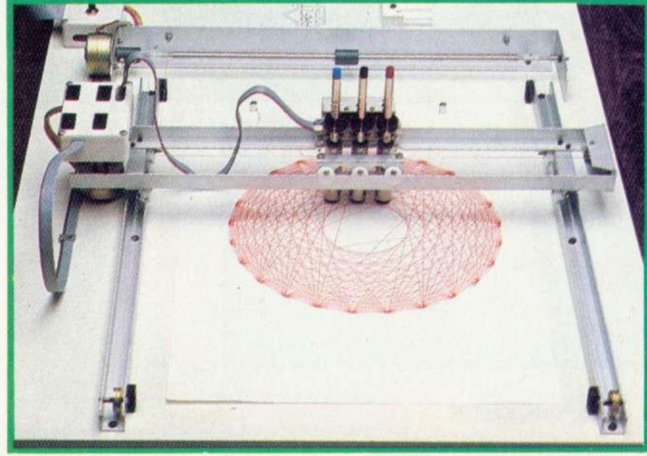
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THE EXPERTS

WATCH MY LINE

Chris Steele sees an educational potential in the Parfitt plotter

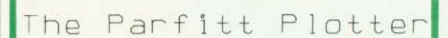


The plotter draws an outline map of Britain from a scanned image stored in memory and displayed on the screen



The plotter drawing under the control of a recursive routine

DESIGNERS tend to be particular about the quality of an image. Teaching 'computing in art and design' in an art college is not easy, and when the students realise that the final product is to be either a screen photograph or a screen dump they often lose interest altogether. But demonstrate a plotter drawing a grid



Handwritten by the Parfitt plotter

with great accuracy and speed and interest is rekindled.

The important difference is that a plotter moves a pen across the surface of the paper, so creating a continuous line. This produces an image of vastly superior line quality to that produced by the pins of a dot matrix printer.

Plotters tend to be very expensive, so the introduction of a cheap A4 three-pen plotter by Parfitt Electronics will arouse a lot of interest in education (see prices panel, page 149).

First impressions are often deceptive and the Parfitt plotter proves no exception to the rule. At first it seems to be a prototype development model, with bare stepper motors and extruded aluminium section mounted on a laminate covered chipboard base – nothing is left to the imagination.

Once unpacked, the ribbon cable from the plotter is attached to the user port on the BBC and the power lead attached to either your micro or the external supply which Parfitt will supply. Three pens are supplied with the standard kit to get the user off the ground.

The manual, which is quite sufficient for the frequent user, is carefully laid out.

Software is provided to enable the plotter to be used easily from ordinary Basic programs. This must be loaded before the plotter can be used.

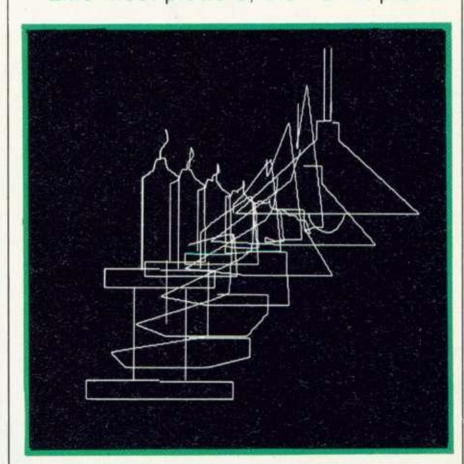
Calls are provided for PMOVE and PDRAW as replacements for normal graphics commands, but also for PLINE (draw a line between two points), PBOX (outline a rectangular area), POFFSET (to move the origin), PINIT (reset the plotter), PORIENT (set the orientation of text), PSTRING (to print text) and PSPEED (to control the drawing speed of the plotter). The code takes up 1.5k of the memory.

Demonstration software is supplied on a menu-driven autoboot disc and you are encouraged to make a backup. Setting the plotter up is a bit of a drag. First, the pen guides, pens and pen-lifting rings must be carefully adjusted so that the pens are actually off the paper when the software thinks they are. The drawing medium must be firmly attached to the base so that it lies perfectly flat.

None of this is difficult – just time-consuming and not something students seem willing to do.

The plotter is provided with three coloured fibre-tip pens, but Staedler drawing pens can also be accommodated. In practice we use many types of material, from acetate to line board, to draw on. Different thicknesses of paper, though, require the pens to be set to different heights – more frustrating minutes sliding the lifting arms up and down the pens.

Like most plotters, the Parfitt plotter



Scraper board design by the author, cut with scriber

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drives the pen across the drawing surface with two stepper motors. It is the size of each discrete step the motors take that determines the quality of the line produced. Even with the best plotters, costing a hundred times the price of the Parfitt these steps are discernible at close range by the jaggedness of the line. The step size on the Parfitt is 0.25mm, which produces noticeable steps in all but horizontal and vertical lines.

The Parfitt has performed very well at Canterbury College of Art, proving robust and dependable. (In education 'robust' can be translated as 'tank like' when you consider the unintentional abuse which students subject equipment to.)

Graphics students have used the plotter to develop simple grids for page layouts and plots on which to develop their ideas at home. Drawing grids manually can be so frustrating that seeing the plotter in action prompted one graphic designer to proclaim that he now had all the reason he needed to buy a BBC computer!

Both software and hardware appear to be under constant development. A 'soon to be launched' triple software pack will include a Logo implementation, a 'pottery' or 'glass' design pack allowing simple forms to be rotated (this will look familiar to users of Gino) and a 3D package (which looks very much like one I first saw on the 380Z).

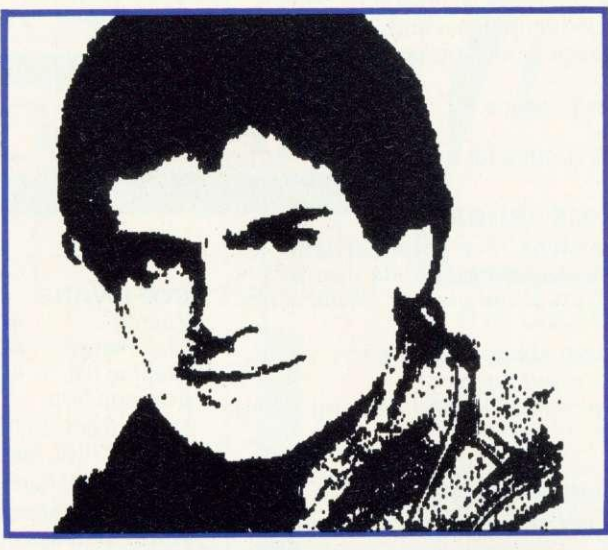
On the hardware side there is now a scriber that can be used with scraperboard, an opto-sensor for scanning images, and a drill/router for cutting into a material. A combined kit could (with the right software) allow an image to be input from paper, manipulated on screen, and then drawn, scribed or cut out by the plotter. The present software takes 20 minutes to scan an image, which is a drawback.

Parfitt Electronics believes that 95 per cent of its market is in the education field.

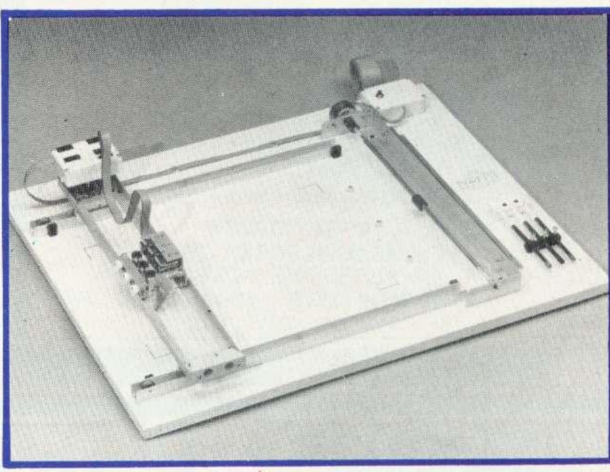
I doubt that there are many personal users willing to pay for a plotter. However, there is nothing like this product on the market at the moment – the MCP40 plotter can use only 4 in. wide paper and the Data Efficiency strobe graphics drum plotter is nearly twice the price.

I believe the most useful application of the Parfitt plotter is as a demonstration tool. Out go the dreary slides of computer drawings or computer controlled machinery, in comes a Parfitt plotter.

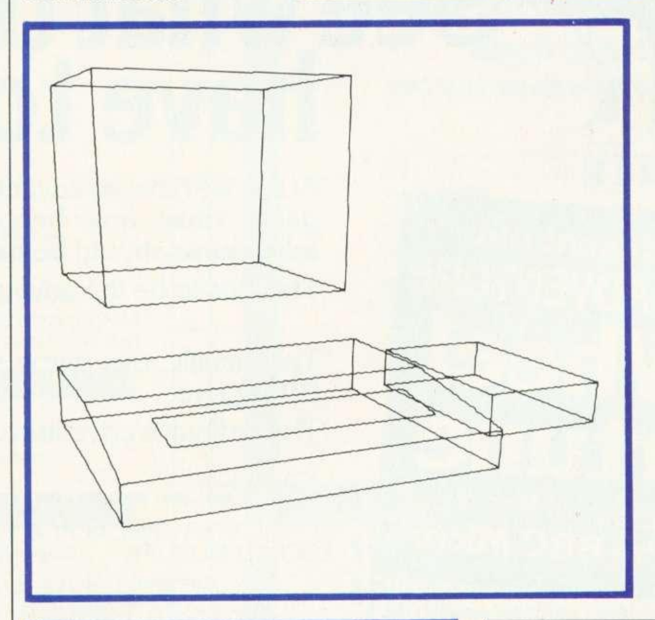
It visibly demonstrates how a computer can control the physical world, and in this respect its naked appearance is an advantage. Students can see everything working.

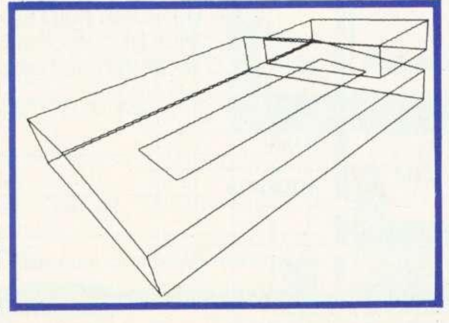


Photograph digitised by the Parfitt plotter's opto-sensor, then dumped back onto the plotter using the software provided



At first glance the Parfitt plotter looks like a prototype development model, with bare stepper motors and a laminate chipboard base – but its nakedness is actually an advantage in demonstrations





Three dimensional plotting (left and below) of the Beeb, monitor and disc drive, produced from the author's own software

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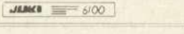
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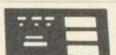
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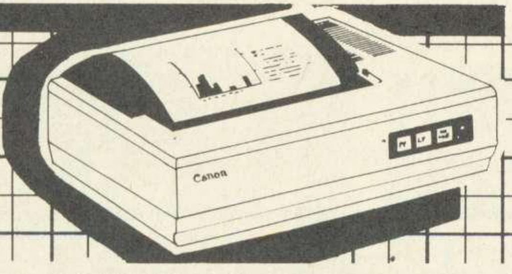
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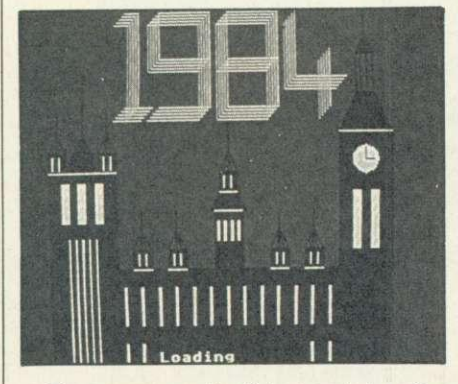
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YOUR STARTER FOR NUMBER TEN

'1984', Incentive Software, BBC B, £6.50

NOT, as you might think from the title, the latest arcade game with Winston Smith being pursued by man-eating rats and Thought Police. Instead *1984* is about the rather more mundane task of running the nation's finances, with you as Prime Minister.

Using the 1982/83 economic figures as a basis, you have to decide on the levels of Government spending, income tax rates and wage settlements for 1984. Unless you make a complete mess of the first year and are forced to resign, you can then go on to balance the books for subsequent years – the ultimate goal being to stay in office until the 21st century.



The program itself is loaded using four different sections – an increasingly common device designed to stop piracy. The first section – the 'loader' – draws a rather nice Houses of Parliament and then, to the chimes of Big Ben, loads in the rest of the program. The next thing you see is the Government's balance sheet showing expenditure and revenue. For 1982/83 these balance at £140bn and ideally they should balance each year. Then you get the eight major economic indicators: inflation rate, unemployment, gross domestic product, gold reserves, industrial output, balance of trade, average wage and exchange rate. Together these show how the economy is faring each year, but you can also see a graph of how each indicator has changed during your years in office.

At the beginning of each year, the first thing you have to set is the Minimum Lending Rate, which affects bank interest rates. Only small changes are allowed, so if it stands at 9 per cent you can't change it to 5 or 20 per cent – the effect on the economy would be devastating!

Next you negotiate the year's wage settlements for the Civil Servants, the Public Sector and the Private Sector. Outlandish settlements are not allowed: if the Civil Servants ask for 8.7 per cent and you offer 100 per cent you will be forced to resign – end of game. On the other hand, if you offer only 2 per cent, such a derisory figure will be rejected and their claim will go through. Unlike real life, though, you only get one round of bargaining.

The level of funding for the various Government departments is decided next, and this is where party policy can be put into practice. You might, for example, want to increase spending on Social Security and Housing at the expense of Defence and Transport. You cannot make really drastic cuts, and if any departments are seriously underfunded a warning message appears. Huge increases will be greeted by the message 'Public Spending out of Hand' and again you will be forced to resign.

Next you temporarily become the Chancellor. In your Budget you can raise extra money from VAT, income tax etc, or increase unemployment benefit, child benefit etc. I noticed a rather drastic bug here: if you reduce any of the tax rates – VAT for example – to zero, it cannot be raised again, because you cannot increase any rate by more than 10 per cent and a 10 per cent increase on zero is still zero!

If you survive the year you get an opinion poll of your popularity; if it falls below 45 per cent you're in trouble! Before going on to 1985, you can see the balance sheet and major indicators showing how well you managed 1984.

Playing *1984* gives you quite an insight into how the country's finances work. For example, it is very difficult to stop inflation spiralling away – from an initial figure of 4.8 per cent I had it topping 20 per cent by the end of 1986. Included with the program is a little booklet entitled 'A Pocket Guide to Running Britain'. Perhaps a complimentary copy should go to 10 Downing Street?

Geoff Nairn

SHOOT THE MEANIES . . . AND HOME TO MOTHER

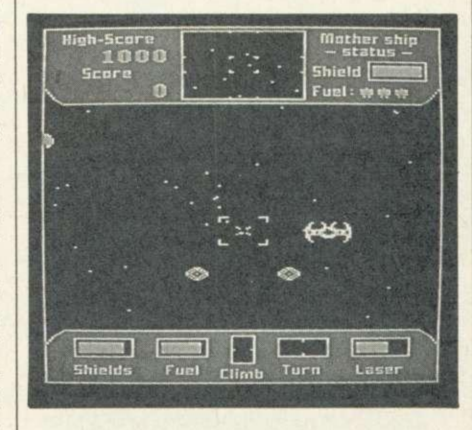
'Cylon Attack', A&F, Unit 8, Canalside Industrial Estate, Woodbine Street East, Rochdale, Lancs OL16 5LB, BBC and Electron, £7.90

A COUPLE of years ago (when my Beeb was still a figment of the postman's imagination), I started to daydream of a computer game where you could fly a mission in space by being launched from a space station, fly around attacking three dimensional nasties and then fly back to dock with the mothership again. Later that same year Buck Rogers started doing just that and now A&F has gone a long way towards providing my original dream at the comfort of my own keyboard.

To play, you launch from your mothership into space, the blackness of which is interrupted only by the distant galaxies and the occasional advertisement for A&F. Almost immediately aliens start attacking, zooming in larger and larger and firing at you. Your own bolts may be discharged by pressing the space bar – A,Z,<,> and *,?,Z,X control options are provided, plus joysticks – and, if on target, the ship disappears in a cloud of space debris. If you eventually hit a sector of space where there are no meanies around to take shots at you, your long range scanner, immediately above your cockpit view, can be used to search for others. If you destroy everything in the current attack wave, you have to search out your mothership and redock to replenish fuel and shield energy.

There are two types of alien on the first wave, rising to four by wave three, and they all grow more numerous and aggressive as you progress. One type even spawns another, so that the enemy may replenish its forces during an attack.

You may refuel during an attack wave (and at the higher levels you will



be forced to), but all the alien's venom will then be concentrated on your mothership. Loss of all shield energy (or destroying your own mothership) signals the end of the game.

Cylon Attack is as good a space game as you're going to get on the BBC micro at the current state of play.

Simon Williams

O WELL OF FORTUNE

'Dallas', Cases Computer Simulations, BBC B and Electron, £6.95

YES, your worst thoughts have been realised – a game based on the wheelings and dealings of everyday oil folk in Downtown Dallas. You are head of your own oil company and the aim of the game is to accumulate $200m and so buy out the dreaded Euings – note the subtle change in spelling.

On the screen is a map of Texas and you have to buy up various plots – 'concessions' – so that you can drill for oil. Seismic surveys tell you whether there's any oil in your concession, and if there is you then have to build rigs, production plants and pipelines to get the precious stuff out of the ground.

You start out with $100m in cash but a few fruitless surveys and unproductive wells can soon have you in debt, at which point you fall prey to a takeover from the Euings. Actually, they seemed to buy me out no matter what action I took: obviously I'm not the material of which oil barons are made.

One major drawback of the program is that new concessions are offered for sale at pretty infrequent intervals. If you don't have any wells producing, there's nothing to do but wait for a concession to flash up on the map.

Another gripe: the inlay card's loading instructions say 'Type CRUN "DALLAS" to load program'. Not on my Beeb you don't.

There are good serious business games available for the Beeb, and there are exciting 'fun' simulations. Unfortunately Dallas is neither – though it does play a rather good version of the Dallas signature tune. **Geoff Nairn**

REFLEX ACTION

'Fortress', Pace, BBC B, $8.95 (disc £11.95)

FORTRESS is an excellent version of the arcade dazzler where you pilot a plane over a hostile landscape, shooting everything in sight before it gets you.

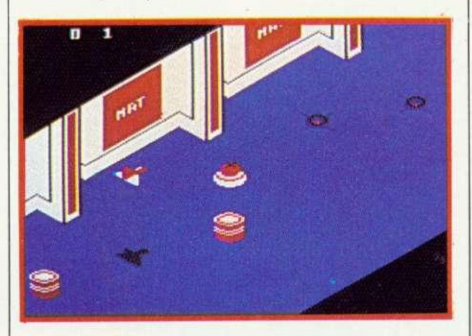
It's really a 3D version of the *Rocket Raid* genre and represents the best so far in the use of hardware scrolling. The ground is blue, and on it is the shadow of your own craft – which is the only clue to your height above the ground. Fuel is in very short supply, so you must shoot up the enemy supplies to increase your own stocks (?).

The enemy appears in the form of rockets launched from silos, planes which sit around waiting for you to come to them, ack-ack batteries and various solid obstacles such as walls.

Controls are well laid out, with options for joystick, freezing the action, sound on or off, and even to alter which keys control what.

Loading presented problems, however. First a disc loaded would run, but then the screen scrolled and wouldn't stop. A cassette copy loaded well, but then crashed after a few goes. Two out of two duff copies is a bit off. Pace has got a winner here, and it's a pity the loading problems delayed my review, and stopped me getting too far into it.

Fortress is a reflex game, but a rather superior example. If you fancy yourself as a Bobby Dazzler of the keyboard, you'll want it. **Tony Quinn**



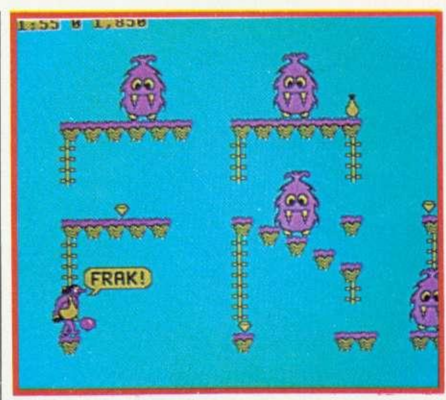
ROCK WITH THE CAVEMAN

'Frak!', Aardvark Software, BBC B (OS1.2), £8.90

FRAK! introduces a new word into the vocabulary of Beeb users. It's one of those words you use when a favourite game won't load from tape, but has been coined originally by the caveman hero of this gem from Aardvark.

He shouts it out in a large yellow bubble whenever he falls from the grassy sods and ladders that it is your task to keep him on, gets pricked by one of the arrows falling from the sky, bumps into a monster – or is hit by a rising pink balloon. Such are the dreadful fates awaiting him, at least in the stages of the game I reached. It's a shame he never actually shouts his word from the Beeb's speaker, but then perhaps he does later on.

The outstanding thing about all this is the graphics. Sprites are used with gay abandon, and they're the best little sprites you ever did see. The charac-



Our hero, struck by a rising balloon, utters his favourite curse . . .

ters could have stepped right out of a Disney movie from the good old cartoon days.

And when your alter ego gets one of the monsters with his only weapon (no, it's not a wooden club), the baddie goes shooting off the screen. Exit right in the extreme!

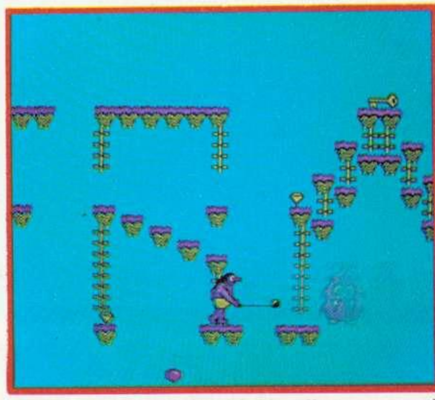
Frak! represents one of the new wave of BBC games that are at last living up to the machine. It is well-crafted, amusing, and, if not totally original, is a very far step from its ancestors.

Only two gripes from this reviewer. First, had I known the word *Frak!*, I would have used it several times trying to load the game from cassette. I loaded *Fortress* and a couple of others with no hassle, but this one took about 10 tries. (To give Aardvark its due, the company promises immediate free replacement to anyone who can't load the game.)

The other gripe was trying to ring them to announce my (not very) high score and find out the real high ones. The line was engaged on eight tries over 10 hours.

Frak! will flog and flog. Go out, buy it, put the Aardvark services to the test if you're unlucky with your copy. This is a classic, and who knows, a first edition might be worth a few bob one day.

Tony Quinn



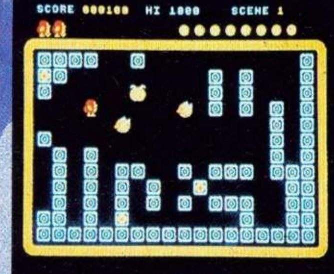
. . . But now he wields his deadly yo-yo, and a monster just f-f-fades away

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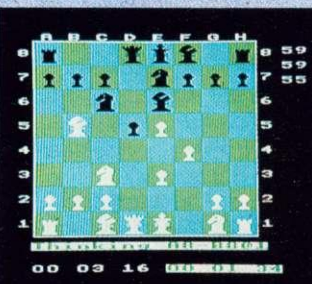




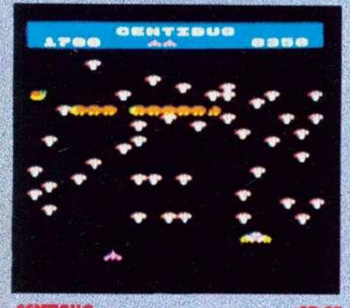
PERCY PENGUIN £7.95
The best version available for the Electron micro. Percy is trapped in an ice maze which is populated by the deadly Snobees. His only hope of survival is to squash them by hurling ice cubes at them. Unfortunately, whenever it seems that he has won, a deadlier breed appears. Hi-score, rankings, excellent graphics and sound.
NEW RELEASE



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From the author of Percy Penguin, Mr. Wiz is a fast-action multi-scene game. Guide Mr. Wiz around the garden to eat the cherries whilst avoiding the evil gremlins. The gremlins can be killed by dropping apples on them or by throwing the crystal ball. Extra points can be gained by eating the magic mushroom, but beware...this is the home of the gremlins and makes them permanently furious! Sound effects and tunes, hi-score, rankings. Superb arcade-style action.
NEW RELEASE



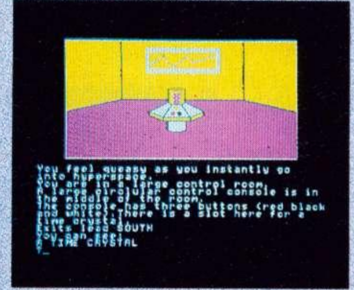
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FAST AND FURIOUS

'Overdrive', Superior Software, BBC B (32k), £7.95

IF you've ever fancied your chances in a Formula 1 car race, *Overdrive* may give you something of the feel of being behind the wheel. You have four basic controls over the Ferrari-red vehicle at the base of the screen: to steer left and right, accelerate and brake. These are smooth and responsive and the illusion of movement created by the flashing white kerb-markings is fairly effective.

The main challenge throughout the five stages of the race is to avoid the other cars as you overtake them. The number you overtake depends on your speed, which can rise to more than 200mph. This is clocked up on an attractive LED-style display at the top of the screen, along with your score, bonus points and the time remaining for the current stage. If you haven't achieved a high enough position on the grid, you can't advance to the next stage. You are very vulnerable if you collide with another car, since this seems a heaven-sent opportunity for every other driver in the race to plough into the back of you before you have time to pick up speed again.



In the first stage, avoiding other cars is fairly straightforward, as they maintain strict lane discipline, but after that they start to weave in a pretty suicidal manner (and at night too). This really is a round-the-world trip, with different stages running through snowfields, the desert and along a causeway in the middle of a lake!

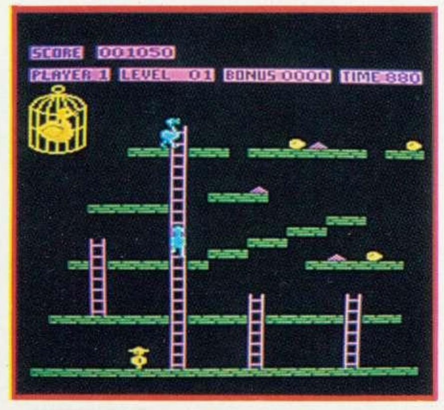
A simple enough concept for a game, but well executed with fine graphics. The only disappointment is the lack of any bends. The contest to produce that on the BBC, however, is another race altogether. **Simon Williams**

A SCRAMBLE FOR EGGS

'Chuckie Egg', A&F, Unit 8, Canalside Industrial Estate, Woodbine Street East, Rochdale, Lancs OL16 5LB, BBC and Electron, £7.90

I COULD almost say this program needs no introduction, since it has featured at various positions in *Acorn User*'s Top 20 for the past few months. And I'm not surprised.

Chuckie Egg is a 'platform' game in the best tradition; you steer a rather portly farmer along ledges, up and down ladders and on and off lifts to collect eggs and remove piles of grain from the path of the marauding geese (actually more like emus) that pursue you. You collect a time bonus and points for every egg and pile of grain picked up. A large yellow duck is held quacking in a gilded cage at the top left-hand corner of the screen, and comes into its own at higher levels.



The graphics are good, though not spectacular. Each character is only single-colour, although quite chunky, and the geese are well animated as they peck at the grain.

Control is from the keyboard only, but the keys are redefinable, and there's a high score table to add your name to in all but the shortest of games. The main attraction of the program is that movement and control of your playing figure is very smooth and reassuring. You lose lives not because it's hard to get your figure to jump properly or line him up with ladders accurately, but because you mistime your moves and the psychopathic birds get you. This builds up just the right amount of annoyance to make you want to play again.

You have five lives, so a good long game isn't difficult to achieve.

Although not one of the most visually exciting games around, *Chuckie Egg* is certainly one I'm glad to have in my clutch. **Simon Williams**

QUASIMODO'S QUEST

'Hunchback', Superior Software, BBC B, £7.95

THE surge in home micro sales is due in part to the implementation of arcade games on the micro. One such game is *Hunchback*, which is as good a copy as you could expect. Superior Software sells the game under licence from Ocean, who originally wrote the game on the Commodore, and the Beeb version is near perfect.

The object of the game is for the hunchback Quasimodo to rescue Esmerelda from a castle tower. To reach her he has to get past a series of obstructions, so we find the Hunchback jumping across the ramparts or leaping Tarzan-style onto a swinging rope to reach the other side.

To make life more difficult as the game progresses, guards with spears appear, and boulders and arrows threaten our hero from both sides. The game has 12 different screens, though the setting is one of two basic types. The object within each is for Quasimodo to cross the screen from left to right to pull the bell rope on the right-hand side. The screens vary in their difficulty and the user can choose which screen to start from, and three different levels of play are available.



The sound effects are adequate but an option to turn them off is sadly missing. Unusually, and pleasantly, only three keys are used, and these are conveniently laid out for ease of use. The game can be played on keyboard or joysticks and includes a high score table.

The only fault with the software was the sideways scrolling across to the next screen which fails dismally. The movement is very jerky.

That said, I thoroughly enjoyed *Hunchback* and I'm pleased that my local pub is no longer reaping the benefits of my addiction. **Dee Vince**



Nightingale is by far the most versatile modem available, at the price, for either home or business use. It offers Prestel/Viewdata baud rates (1200/75 & 75/1200) alongside 300/300 baud full duplex for communication between the BBC and other computers, including bulletin boards.

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UPHILL STRUGGLE WITH TURBO

Turbo Compiler, Salamander Software, 17 Norfolk Road, Brighton, Sussex BN1 3AA, BBC, £9.95

THE prospect of producing a machine code program without having to write directly in assembler has always been attractive. One way to achieve this is to work in a compiling language such as Fortran or Pascal, but, leaving aside the necessity to learn a language other than Basic, there are as yet no full implementations of these languages for the BBC micro. The alternative is to compile the Basic code itself, and this, to an extent, is what the Turbo compiler tries to do.

The compiler resides in only 2k of the micro's RAM, so it is possible to have source and object code co-resident in the machine. This means that code doesn't have to be compiled from tape or disc. Once compiled, the code may be used independently of Turbo, either as a subroutine in a Basic program, or as free-standing machine code.

Turbo will compile only a limited subset of BBC Basic and this is perhaps its biggest problem. Keywords handled directly by the compiler are AND, CALL, CLG, CLS, END, EOR, FOR, GET, GOTO, GOSUB, IF, INKEY, LET, MID$, MODE, NEXT, OR, PRINT, REM, RETURN, SOUND, THEN and TO. In addition, the operators ?, ! and $ are supported.

Although the well-produced user guide lists some 65 keywords that may be compiled by Turbo, most of these are only achieved by 'fiddling' the syntax of others. For example, the COLOUR statement must first be translated into its equivalent VDU statement; COLOUR 3 would become VDU&11,&03.

Turbo handles only integer numbers and these must be in hex. Variables are restricted to the resident integers A% to Z% and these may only be assigned values in the range 0 to 255. Line numbers must also lie within this range and multi-statement lines are not permitted.

The publicity suggests that Turbo is an ideal intermediate stage between interpreted Basic and machine code, and it requires a fairly intimate knowledge of the MOS to be able to 'prepare' a program for compilation. Comparing the short program (listing 1) in its original and prepared forms gives some idea of the effort required to use it.

Whether you feel the speed increase (in this case about 25 per cent) is worth the extra effort is up to you. I would rather wait for a more comprehensive compiler that made the machine do a larger proportion of the work.

Simon Williams

```
BEFORE                      AFTER

10 MODE 2                   10MODE2

20 FOR N%=1 TO 255          20FORN%=&01TO&FF

30 GCOL0,N%                 30VDU&12,&00,N%

40 MOVE N%,1023             40VDU&19,&04,N%,&00,&FF,&03

50 DRAW N%,0                50VDU&19,&05,N%,&00,&00,&00

60 NEXT                     60NEXT

70 COLOUR130                70VDU&11,&82

80 VDU28,4,31,19,0,12       80VDU&1C,&04,&1F,&13,&00,&0C

90 END                      90END
```

Listing 1. A short Basic program before and after compiling on the Turbo

MULTI-AID PUTS TOGETHER THREE UTILITY PROGRAMS

Multi-Aid by Dynabyte Software, £7.95

MULTI-AID consists of three utility programs, chained from an initial index program. The utilities are 'Character', 'Soundlab' and 'Graph7', each of which will be dealt with individually. The package comes with a small but comprehensive and simple booklet, and two function key strips.

'Character' is a useful utility for creating multi-coloured, simple or multiple characters, and can be used in all BBC graphics modes except mode 7. You first select the foreground and background colours from a menu of eight colours. Modes 1, 2 and 5 allow three foreground colours and the other two-colour modes allow only one. You then choose the size of the character you wish to create in multiples of the standard eight by eight pixel block. This will of course depend on the mode selected, as explained in the booklet; for example, in mode 2 you can create characters of up to two by three blocks. Having selected this you then define the ASCII code for your first character (between 128 and 255) and you are then ready to begin. To create a large number of multiple characters you will need to use non-standard ASCII codes and will require to explode the character set memory before starting. The use of *FX20 to do so is clearly explained in the booklet.

The next step is to select the option to define new characters or edit existing ones. In either case, each character is displayed normal size, and eight times normal for working on. All you now need to do is move around the display area using the cursor keys and set the pixels as required using the function keys for the desired colour. Another useful function controlled by these keys is the ability to copy a character, simple or multiple, to the next equivalent ASCII codes/memory area, effectively duplicating it. You can then carry on editing to make minor alterations for, say, animation, and avoid recreating the whole character. Similarly, you can list the resulting VDU23 statements, each of which also illustrates the character, and *SPOOL them to use in programs.

The booklet also explains how to recombine the VDU commands into the whole characters within any program. One criticism is that you are not able to use flashing colours. Another is that if you totally 'fill' the memory, you get a 'Too few characters left' message, from which you have to escape and re-run the program. However, you don't lose any of the work you've done as long as the same parameters are used.

'Soundlab' is a comprehensive utility for exploring sound and envelope commands by creating or editing your own commands or using the examples provided. It allows up to seven envelope and nine sound commands (including channel 0). The facilities for editing (including any one of the seven sound parameters individually), playing sounds singly or in sequence, killing a sound, altering any parameter whilst a sound is actually playing and so on, make it a very flexible utility. As with the 'Character' routine, all the created



commands can be listed and incorporated in your own program.

'Graph7' is yet another mode 7 screen generator for creating text, graphic or combined teletext screens. It makes use of the function keys on their own and in conjunction with the control and shift keys. Once you get the hang of it, it's quite easy and efficient. Special functions allow you to save up to 24 screens in memory at one time, and to switch between them. You can also *LOAD previous screens to look at or edit, and *SAVE or *SPOOL any screen to include in your own programs.

The package requires the 1.2 OS, but will work with either Basic. I would class it as one of the better utilities available: it is comprehensive and good value for money. If you do not already have any of these facilities, this is one I would definitely recommend.

Ian Rowlings

HELPING HAND IN CALCULATIONS

'Titrations' by Shaw, Melia and Ellis, System Software, Arnold Wheaton, BBC, £14 plus VAT (tape and disc versions)

THIS very thorough and professional program provides 'a means for students to self-check the results of calculations associated with some acid base and acid carbonate reactions'. It is designed so that the student who has difficulty in accurately rendering the calculations may be guided through the process in a structured way.

The student using *Titrations* needs to be familiar with molarity and the way in which it relates to concentration. It is recommended that the students have a calculator handy – I certainly needed one. They are presented with the choice of dealing with figures supplied by themselves from their own experimental data or of using computer-generated problems as revision and remedial material.

Two levels of difficulty are available and, after choosing, the pupil will be asked to calculate either a molarity or a volume. When errors occur the machine branches into a HELP routine appropriate to the point in the equation that caused the difficulty. Continual failure to understand the help given results in the machine performing the calculation itself step-by-step, with the parts of the equation being operated highlighted. The program is patient, perceptive and persistent.

Although it is not very striking visually – it's all printed in cyan text on a black background – this perhaps underlines the serious intent of the program. It is designed to be used as a scientific tool and has no fancy frills. However, a print-out facility might have been useful so that the results, especially of pupils' own calculations and experiments, could have been taken away as hard copy.

Titrations is a robust and efficient program that uses the simple techniques of repetitive reinforcement to enable students to attain high standards of accuracy in their equations.

Nick Evans

SURREAL PHRASEBOOK

'The Storyline', Daco Software, 59 Mackenzie Road, Moseley, Birmingham B11 4EP (021-449 2253), BBC, £7.95

THE STORYLINE is a text-handling program that enables a budding Shakespeare to produce some most peculiar, although strangely fascinating, stories. I am sure that the original intention of the program was for the child using it to create sense in a normally acceptable fashion, but the side-effect is that the text produced by the program has a strange surrealist quality about it:

'I rang the bell. Then, a thin clown saved me and then the thing dodged it. In the end, it walked out of my head.'

The seven-year-old T S Eliot who created this masterpiece was fascinated by the weird atmosphere and unreal quality that this sort of 'random text' produced. Of course, it need not necessarily be totally random since the child who is using the program governs what goes into it at each stage.

One day the baby giant ate the pram. My mum hid under it. But, a tall boy pushed him and then I ran from the thing. Long after, it walked out of a nest. Stiffly, one more pretty frog was lost in the pram.

You

Press X to keep the word(s)
Press any other key to change

There are two levels of operation, with vocabulary of varying degrees of difficulty. The words to be chosen are flashed one by one on the screen and you may choose to keep the word by pressing 'X' or try another by pressing any other key.

On pressing 'X' the word is transferred to the top of the screen in the next position available in the sentence under construction. One thing that my test-pilot found to be a problem was that if, in his enthusiasm, he made a wrong choice there was no way of deleting the chosen word – in fact, editing facilities are nil, which severely limits its use. You may send the whole story to the printer at any point or view it on the screen. After printing, the same story may be continued or another started.

The program centres around the use of data, accessed line by line, in a syntactically governed order. So, for example, the opening may be 'Long ago' or 'One day' or 'Once' or any others out of a selection of ten choices within each phrase's data line. Then comes the definite article, followed by an adjective and then the subject noun, a verb and finally a direct object. This structure varies as the program progresses.

The Storyline is a most interesting program with great possibilities at the junior school and remedial levels.

Nick Evans

CHARACTER MATCH

'Alphabet' by D J Millidge, Opalsoft, £9.95

THIS program, which comes in two parts on cassette, claims to 'stimulate the interest of children of all ages, especially beneficial to those learning their ABC'. It does this by the use of the extensive graphics facilities of the BBC, which are used with some imagination. The presentation is pleasant and does not distract from the task in hand. But here's a problem – what is the task in hand?

A child of, say, four or five years old who has just started learning to read is expected to look at the picture displayed on the screen and associate that picture with one of four lower-case letters that are presented in a row underneath it. The question is whether it is either educationally valid to make associations between letter shapes and printed words rather than between

letter sounds and aurally received words when the child is at the 'ABC' stage, or whether it is indeed possible for the brain of a child so young to make that 'leap'.

Having chosen the letter the child then moves an arrow using the cursor control keys until it is positioned roughly under the letter and presses COPY (why not RETURN?) in order to confirm his choice. If the choice is wrong a large cross appears, the word itself is displayed under the picture and the correct letter highlighted. The wrongly answered picture is later returned to and the process continues till all pictures are covered.

Another problem, which arises with all programs of this type, is that the characters displayed in the book are not compatible with those on the screen. Nor are the pictures in the book compatible with those in the program – 't' for tree in the book and for tardis (!) in the program.

These inconsistencies appeared in the first part of the program and were then corrected in the second part when the letters were done again.

All in all it was a peculiar program; a shame as the graphics and sound were fun.

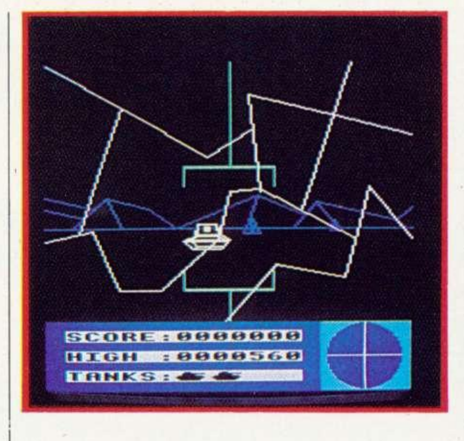
Nick Evans

BATTLE LINES

'Battletank', Superior Software, BBC B (32k), £7.95

CONSIDERING the amount of memory available on the BBC when using hi-res graphics, it is something of a wonder that anyone should try to mimic a game as graphically complex as *Battle Zone*. The arcade original employs vector-scanning techniques in a similar way to an oscilloscope. To simulate this on the Beeb requires some pretty complex line-drawing algorithms, and unfortunately this shows in *Battletank*.

For those who don't know the scenario, you move a rather futuristic tank around an isolated plateau, taking pot-shots at any enemy tanks you can get in your sights. *Battletank* doesn't sport the landers and flying saucers of the original, but does add a colour element. Control is via keyboard only – the game wouldn't lend itself to joysticks anyway. The main problem is that everything moves rather slowly and jerkily. It is very difficult to get the opposing tank into your sights, not because of its agility but due to the resolution of screen movement. To achieve reasonable tank speed, Superior has had to make each movement step quite large. The same is true for the scrolling of the landscape.



The program appears to have been written in mode 5, a decision I would question in view of the greater resolution available in mode 4. Since the original game is in only one colour, it would perhaps have been a better bet to stick to this scheme and drawn more accurate tanks and pyramids.

I have a lot of admiration for the programming skill involved in writing *Battletank*, but still feel the game loses its interest quite quickly because of the lack of variety.

Simon Williams

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UNICORN

◀ *page 141*

necessary, according to Torch, to attain compatibility with other products. A sound reason, but it slows down the operation of some Unix facilities to an almost unacceptable extent.

In other words, the 256k memory and 8MHz 68000 processor are just about capable of handling Unix successfully; put the bottleneck of the 6502 between them and the vital hard disc, and some processes become seriously delayed.

This problem might be overlooked were it not for the way it interacts with other, apparently minor, deficiencies. We have already mentioned that pressing BREAK loses the whole Unix session, and this is more annoying when it takes four minutes (no less!) to log on. When using the screen editor 'vi', the regular transfer of data to disc, unnoticeable on most systems, takes about three seconds on the Unicorn. This means that suddenly the letters you are typing fail to appear on the screen, and a three second delay occurs before they do, all in a rush. This happens once a line, not once a page. Since the whole idea of a screen editor is that the things you type appear on the screen immediately as well as going to memory, this is somewhat annoying.

Given that Torch is unlikely to change the architecture to the extent of eliminating the hard disc bottleneck, the company could perhaps recognise the data transfers to make them less intrusive in the contect of interactive processes such as text input and editing. This is a relatively minor change, and the kind of thing Torch should have put right much earlier. For non-interactive processes it is not so annoying, though it still slows things down.

Otherwise the Unicorn provides an impressive, low-cost introduction to Unix. All that you might expect is there (even YACC, the Unix compiler-compiler) bar the tutorial and manual facilities usually found on big systems. These would have used up too much disc space, and Torch wisely decided to concentrate on good-quality printed manuals rather than wasting disc space putting the information in the machine.

The slowness of the hard disc transfers belied the speed of execution of the 68000: timing tests showed that it was doing okay provided it didn't have to wait for the 6502 to transfer a big lump of data for it. Usually that was the downfall of the execution times.

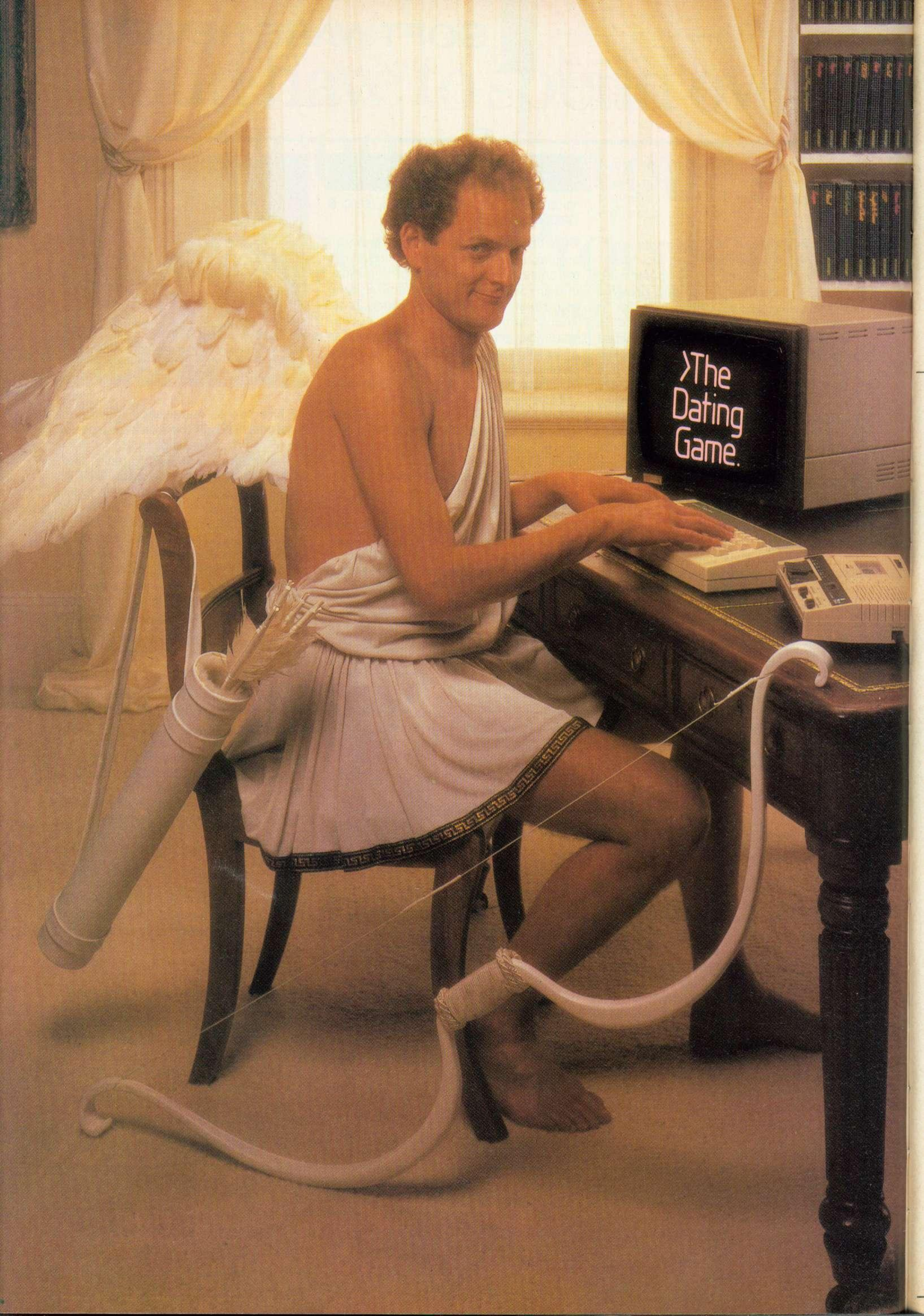
Overall the system was impressive but slow. Torch has one or two things it should definitely sort out (principally the BREAK key and the regular hang-ups in 'vi' for disc transfers), but the problem of the slow hard disc transfers is probably built-in. It will be interesting to see what happens in a 512k or 1Mb machine.

A good buy? Possibly. There are systems costing less than twice the price that I think are probably twice as good. But there is no route to Unix quite as cheap as the Unicorn. When the Acorn 16032 second processor comes out, ostensibly providing Xenix (from floppy discs?) at around the £1,000 mark, Unicorn will no longer be the cheapest. Even then, however, it seems likely that we will be getting roughly what we pay for in every case.

The likely market is difficult to pin down. The Unicorn is not really for business use, unless the business happens to be software or at least has somebody around who can make use of Unix. It cannot be used by more than one person simultaneously, but is out of reach of all but the richest hobbyist. The serious systems programmer or small software house is the most likely target, and the university or college microcomputer section. Yet for most of us it will probably seem too slow.

So you might be a foolish virgin to go for Unicorn. On the other hand, it is one way of becoming a wise virgin, in the sense of getting genuine interactive experience of Unix.

The trouble is, to achieve the wisdom of Solomon, you may need the patience of Job.



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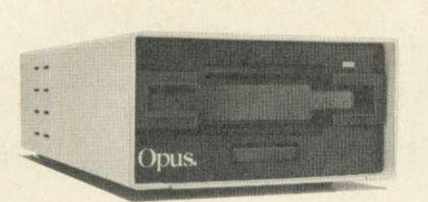
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Canada

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30 Leicester Villas
Hove
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London NW6 5UL
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Oldbury
West Midlands B68 0QZ

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Room 12a
Norwich City College
Ipswich Road
Norwich NR2 2LJ

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19 Meadowplace Road
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Tel: 031-334 8483

■ Robin Bradbeer
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Polytechnic of North London
Holloway
London N7 8DB

✓ Andy Purkiss
North & Mid-Essex User Group (NAMEBUG)
12 Palm Close
Witham, Essex
Tel: 0376 515609
Prestel: 376515609

✓ M. A. Cowley, President
Beebnet
PO Box 262
Kingswood
South Australia 5062

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23 Hitchin Road
Henlow Camp
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✓ R. Welch
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7 Tylers
Harpenden
Herts AL5 5RT

■ Mr P. Frost
Atom Users Group
3 Leyland Road
Bulkington
Warks CV12 9LW

■ Ray Mitcham
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5 Easedale Avenue
Ainsdale
Southport
Tel: 79936

✓ The Secretary
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39 Aldworth Road
Stratford
London E15 4DN

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Northants

✓ **BBC INFO**
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Skippergt. 6
3190 Horten
Norway

✓ E. R. Piper
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2 Ely Gardens
Aldwick Park
Bognor Regis
Sussex PO21 3RY

■ Andrew Pike
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920 Bourges Boulevard
Peterborough PE1 2AN
Tel: 0733 44342 (after 5pm)

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75 Swanlow Lane
Winsford
Cheshire CW7 1JD

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1 Rowan Close
Bottisham
Cambridge CB5 9BN
Tel: (0223) 811487

✓ Brian Pain
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✓ Duncan Coulter
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8 Briar Grove
Ingol
Preston PR2 3UR

■ **Acorn Users Group of Sweden**
c/o Janne Soderberg
Frihetsvagen 32
S-175 33 Jarfalla
Sweden

✓ Anders Wickman
BBC User Group (BUG)
Folkungagatan 58
116 22 Stockholm
Sweden

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26 North Cape Walk
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BBC Disc User Group
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Bristol BS1 4AA

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229 Manley Road
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27 Oribi Avenue
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Kempton Park 1620
South Africa

We've been absolutely inundated with Free ads — something like four times as many as we can carry. This has led to long delays in publication and disappointment for readers. The free ads are carried in the magazine as space permits, so please allow up to four months for yours to appear.

Acorn User has been alerted to the abuse of the free ad service and, regrettably, can no longer accept entries selling or swapping software.

FOR SALE: HCR EPROM programmer for BBC, as currently advertised, costs over £53 new, will accept £40. Andrew Pearson, tel: 0533 555599.

ATOM. Wanted: Maths Pack 1, Desk Diary programs, also Acorn Eurocard 40 character VDU card, plus circuit diagram for Atom colour board. Tel: John, evenings, Danbury 3888 (Essex).

WANTED. Copy of the 8271 FDC data sheet. Will be prepared to pay for copying and postage. Tel: Polegate (03212) 2438 (evenings) and ask for Paul.

TEAC disc drive 40/80T, double sided, utilities disc, leads, £220 plus postage. Tel: 0726 4246 after 6 pm or weekends.

WANTED. BBC disc interface kit or 8271 chip. Tel: Bristol (0272) 833568 evenings.

TORCH Z80 second processor, £250. Requires dual 80T disc drive. Microline 82A printer, £275. Watford Electronics ROM board plus 16k RAM (6264-150ns), £80. Gemini Cashbook and Home Accounts, £100. Tel: (0243) 573951.

SEIKOSHA GP-100 A printer (Mark II), unused and almost new cable, spare ribbon. £140 or offers. Peter Ballantyne, Norwich (0603) 413785, weekends only.

WILL EXCHANGE Jen SX 1000 synthesiser plus amplifier for BBC B hardware and/or software. Write or tel with offers to I. Smith, 52 Sunnybank Ave, Bispham, Blackpool (0253) 54926.

DISC drive. Oliveti 5¼", as used by Acorn. S/S S/D 100K, with leads, manual, utility disc, 7 months' guarantee, £100. DFS £15. Speaking watch, £30. Tel: Hornchurch (04024) 71789 after 6 pm.

WANTED: Atom Wordpack ROM and manual; also a photocopy of 2 missing pages from Atomic Theory and Practice. Will pay £15 to £20 for Wordpack. Tel: Mark 01-732 3053.

DISC drive. Single Teac double sided 40/80 track switchable, 200/400k, minimal use, in case with all leads and some discs, £325 ono. Also View A1.4 from Acornsoft, £30 with manuals. Tel: 0327-52191.

PRINTER. Tandy LPVII complete with manual and cable to suit BBC computer. As new condition, £130 ono. Tel: Hayling Island 3793 (Colin Reynolds) after 5 pm.

BBC B 1.2OS, joysticks, programs, magazines, tape deck, dust cover, £325, no offers. Buyer collects. Chris, 56 Thistlecroft Road, Walton-on-Thames, Surrey. Ring Walton-on-Thames 222489 after 8 pm or weekends.

PRINTER. Tandy CGP115, as new, including cables, paper, pens and software, up to 80 columns, 4 colours, decenders, £80. Ring Nigel on 0438 726430 (Stevenage) evenings or weekends.

PACE DFS with utility disc and manual, £20. Allows 63 file names per disc and page set =&1500. Includes M/C screen dump programs. Acorn DFS compatible. Tel: Buckingham (0280) 816475.

WANTED. BBC Model B with DFS. Also Epson printer wanted. Peter Ballantyne, Norwich 413785 weekends only.

HOBBIT floppy tape system (101K) for BBC micro with file system EPROM, manual, tapes etc. Only £64 ono. Tel: 01-368 7561 evenings.

WANTED. BBC B. Tel: Rugby (0788) 71662.

RESEARCH Machines 380Z 32k. Tel: 0603 810675 evenings.

EXPANDED Acorn Atom, 12k plus FP ROM, plus £130 software, plus all leads, plus manual, plus PSU, plus books, plus magazines. All originals and in good condition. Cost £450, sell for £70. Phone Aberdeen (0224) 702258 after 6 pm any evening.

FOR SALE. Nascom 2 microcomputer, 16k plus Zeap, includes cassette and 9" monitor, £250 ono. Mr Hamawi. Tel: Fareham 281209.

WANTED BBC computer model B, level II Basic, 1.2OS with Acorn DFS. Will consider without DFS. Telephone 0480 43020 (Tidworth) after 5pm.

BBC B. B/W monitor, £150 worth of software, all Acorn User and Micro User magazines to date. Books, leads and other relevant listings of programs. Offers. Tel: Saltcoats 65446, ask for David. Buyer collects.

VIC 20 for sale or swap with Acorn Atom 12/12. 16k RAM plus joystick plus £45 worth of software, VIC 20 cassette player as new, still boxed, £100. Tel: (0638) 720363 (evenings only), Fordham, near Cambridge.

CASIO PB100 pocket computer/calculator. Standard Basic, qwerty, constant memory, includes extra internal RAM pack (worth £12), manuals, original packaging. Very good condition, worth £40 plus £12 – sell for £35. Tel: (051) 336 2812 (6pm plus).

2114L memory, ex-equipment tested. Eight for £5. 2118 memory single rail. 16k × 1 eight for £10. Ex-equipment tested. D. Hemingway, Ivanhoe, Glen Road, Hindhead, Surrey GU26 6QE.

VIDEO Genie EG3008 (Z80A @3.5MHz), expansion interface, monitor, LD05 5.12, tons of software, £280 the lot! New 2564 EPROMs, £3.50. Write for details: Mike Tubby, 5 Waterford Close, Worcester.

DISC DRIVE. Teac half height, 40/80 track switchable, double sided, 400k, 6 months' guarantee, includes utility disc, cables, 200-page manual, box of discs. Best price secures. Tel: Richard 021-783 8651 (evenings).

WANTED – Teletype or other printer for BBC B; RTTY hardware and software; Graphics ROM; any speech synthesiser; any lightpen; White Knight II. Write to S. Dyke, Uphill, Whiddon Down, Okehampton, Devon EX20 2QS.

ACOUSTIC modem (Prism) in original packing, £50 ono. ROM board (Watford), £25. Both inclusive of P&P. Tel: Dave 0206 561212 after 6 pm or weekend.

PRINTER. Tandy DMP100. Hardly used, tractor feed with serial and parallel interface; paper; lead for BBC/Atom; manual. Sell for £155. Tel: 041-423 2115.

WANTED: Acorn DFS manual, utilities ROMs, books, hardware, software, or just penpals. Any transaction could be arranged for UK address. All letters answered. K. J. Lim, 44 Charlton Road, Singapore 1953.

WANTED. Latest colour board for Atom, must be in good condition. Michael Lacey, 4 Silverdale Close, Retford, Nottinghamshire DN22 7XP. Tel: Retford (0777) 705405.

16K Spectrum. Repairable 32k memory. Black and white television. Printer plus spare paper. Tape recorder. Books, tape, £160 or swop for hi-res colour monitor suitable for BBC. Tel: (0634) 682607.

BBC Model B, 1.2OS, Sureshot joystick, leads, manuals, software, 6 months old. Uncased, unused 5¼" disc drive. Epson printer MX100 MK III (retails £500), all for £700. Tel: 01-646-5952.

HITACHI 3 inch disk drive with 21 disks cost £280+ sell £200 ono (single sided 100k and BBC compatible). Ring Bill 01-572 2917.

WANTED BBC B minimum. Extras: DFS or other DOS, sideways ROM or RAM etc acceptable. Up to £500 to spend. Serious software/firmware considered. Games not required. Phone evenings or weekends 0503 65436, Lowestoft.

FREE PERSONAL AD SERVICE

Sell your old hardware or pass on information. Fill in the form below to a maximum of 32 words (one in each box) and send it to Acorn User Free Ads, 68 Long Acre, London WC2E 9JH. Use capital letters, and remember your name, address or telephone number. This is a service to readers – no companies please. One entry per form only, and we cannot guarantee any issue.

ATOM wanted. Floating point ROM, Toolkit ROMs, BBC Basic board, arcade games. Send details to: Joel Connault, Le Plan, F38490 La Batie Divisin, France. Tel: 76 3222 17.

GRAPHICS digitiser by Minor Miracles – mint condition – never used (unwanted Christmas present), new – £20, will sell for £14 or swap for Computer Concept's Graphics ROM. Contact Roger 09363 3872 after 5pm.

BBC model B, 1.2OS, DFS, fitted with Wordwise ROM, Sony cassette recorder, manual, cover, etc £420 ono. Phone Leeds (0532) 585853.

PRINTER £50. TTL level serial input plus power unit and software for Atom. Ex-Creed Teletype. Tubb, 35 Burns Road, Crawley, Sussex. Tel: Crawley 513354.

ATOM wants: 8271 controller pay £25; RAM card £10; BBC Users Guide £3.50; Lisp and Forth manuals £3 each; 6502 machine code (beginners) and magic book £2 each. Contact: Steve, 0752 776082.

TANDY TRS80 line printer III, BBC compatible, business quality dot matrix, 120cps takes up to 15in wide paper, mint condition – £225 ono. Tel: Welwyn Garden City 24591 after 6pm.

FOR SALE. BBC B, OS1.2, lead, manuals, boxed. Also many magazines, books, software and dustcover. All for £395 ono. Phone Jason on 0803 28760, after 5pm.

PRISM Acoustic modem for BBC model B. Comes complete with all leads and ROM software in its original packing. £50 ono. Tel: Melton Mowbray (0664) 69013, after 6pm.

WANTED 8271 disc controller chip. Will pay up to £30. Phone Mark, Mold 58650 after 4pm.

OS1.2 ROM new and unused, in original packing with fitting instructions, complete. Double order error, hence surplus to requirements. £5.20, p&p all included. Phone Graham 0902 341189.

TEAC 100k disc drive with cables, manual, formatting and other discs. Used, perfect order. £95. Upminster (040 22) 29912.

ACORN 0.9 DFS ROM for BBC micro, only 3 months old. Sale due to system upgrade. £48. Phone Brian Emmerson 0392 860983 (Exeter).

BBC B 1.2OS, Acorn DFS, Wordwise, software worth £700, 400k double sided switchable disk drive, 34 floppies, green screen monitor. Worth £1,600, the lot for £1,055 ono. Tel: 047 283 378 after 7pm. Kevin Bramhill.

BBC B 32k OS1.2, little used, as new with cassette lead and approx £50 software. Bargain, £350. Billericay 56130.

ATOMCALC wanted, also Forth language for the Atom. Buy or exchange for similar – I have most other non-game software. Telephone Oliver 0626 862747, most times, most days.

CANON twin 40 track double sided drives with psu, double density capability 400/800k. Including BBC connector utilities, disc supplied, £300. Phone Bagshot 75672 (STD 0276).

ATARI 800 home computer plus Atari cassette recorder, three joysticks, music and Basic cartridges, mags and manual. £200 ono. Phone Matthew on Turton 852527 after 5.30pm.

WANTED Beebugsoft Sprite utilities (disc) or Simonsoft Sprites version 2 (disc or tape). Will make cash offer. Also Soft Machine Sprite Master considered. Tel: James, Cambridge 843606.

SILENT Computers' expandable console for BBC – worth over £62 – will sell for £39.99 ono. Also original Simonsoft Disassembler disk (40TK) – little used due to upgrade to 80TK drive – £6.50 ono. Tel: 061-224 0756.

ATOM floppy disk controller card including utilities disk £70. Tel: Bradford (0274) 612529.

8271 disc controller wanted. Will pay anything reasonable. Tel: Steve, Ipswich 680051.

ELECTRON, two months old, virtually unused. £40 worth of books and games – £175 the lot. Phone 0724 733780 after 6pm any day.

UNWANTED gift BBC B and BBC cassette recorder + 30 hour Basic and tapes etc. Cost £490 accept £300, no offers. All as new, boxed, not used. Telephone 0424 214521, Bexhill, E. Sussex.

NEW ZEALAND BBC user would like contact in UK. Would also like to swap software with them. Write: Andrew Phillips, 44 George Street, Geraldine, New Zealand.

BBC B & DFS, Epson FX80F/T, Microvitec mod res monitor, Sanyo cassette, Cumana 400k double drive 40/80, Wordwise, Disc-Doc, 70 games on disc, joystick. Everything, in fact. Cost £2,000+ accept £1,300. Under warranty. 01-850 7689, Eltham SE9. (Robert).

HELP! can anyone tell me how to connect my LA36 RS232 Decwriter 2 terminal to a fully expanded Acorn Atom? Please help! Michael Perris, 51 Barn Meadow Lane, Bookham, Surrey KT23 3EZ. Write only.

WANTED Atomcall ROM and manuals. Max price £10. Contact Mr Luck, EETEC, RAF Coningsby, Lincoln LN4 4SY.

WANTED 8271 disk controller chip. Will pay up to £40, for second hand chip. Bedford (0234) 856050.

FOR SALE. Microvitec 14" RGB monitor £150. Zenith green screen monitor £40. Both brand new boxed. Acorn speech ROMs including manual £25. Wordwise ROM including manual £25. Phone Peter, 01-958 8021 (Edgware, Middx).

FOR SALE. Complete set of Popular Computing Weekly. Total cost price over £36, will sell for £15 plus postage, or swap for ROM expansion board. Ring Andrew on Leek (0538) 383652 after 5.30pm.

BBC computer, disc interface and ROM board £350. Epson RX80FT printer £240. 100k Cumana drive £85. Sanyo high-res monitor £80. View £20. Disc-Doctor £15. BeeBase II £20. Graphics Extension £20. Ring Horley 75547.

WANTED 8271 disc controller. Tel: Ipswich 680051, (Steve).

SOLIDISK 16k sideways RAM board with over £1,000 worth of software including Starbase, Wordwise, Graphics ROM, Ultracall, Printmaster, Beebcall, Toolkit, Beebmon, Gremlin, Exmon etc. Whole package only £150 (duplicated gift). Phone (05827) 69152.

400K Mitsubishi DD/DS 40/80 track disc drive. Supplied with Disc Doctor ROM and 10 discs with Acornsoft business and games range, Gemini business, ROM dumps. Total value £1,500+, sell for £400. Tel: (05827) 69152.

OPUS 100k disc drive with leads, manual, and utilities disc. Six weeks old, £140. 48k Spectrum with £80 worth of software and manuals, 8 months old £90. Tel: (0865) 251684 or (0865) 249891 ext 6019, (Richard).

BBC B 1.2OS and cassette recorder, Wordwise ROM and lots of software including most Acornsoft games, £399. Phone 0705 592006 (near Portsmouth).

FOR SALE. Atari 2600 with two games, four joysticks and adaptor in good condition, £25. Telephone Carlisle 44882 after 6pm and ask for Michael.

WANTED Back numbers of AU, PCW, Byte. Also books for BBC micro. Tom Curran, Hampton, Middx. Tel: 01-979 3872.

WANTED BBC B. Will pay up to £250. Phone 01-474 2488 after 6pm.

SOLIDISK sideways RAM owner (no disks) needs tape copy of sideways RAM utilities (or source of listings). Can you help? Geoff Smith, 84 Edenfield Gardens, Worcester Park, Surrey KT4 7DY.

VETREX computer console includes built-in screen and joystick, three games, as new £50 ono. Phone Paul 021-422 4167 evenings.

EXCHANGE for BBC micro or sell for £353, The Open University: Microprocessors and Product Design – a course for engineers. Complete in original packing. Tel: Aylesbury (0296) 25504.

WANTED Software for Atom. Please send list of games for sale including prices to: Tim Welch, 'Orchard Cottage', Church End, Friskney, Boston, Lincs PE22 8SE.

WANTED 8271 FDC chips. Open to any reasonable offers for an 8271. Data sheets for 8271 and 8272 urgently required. If you can help, ring Stu on 061-485 2848, evenings please.

COMPUTER magazines. Practical Computing 58 issues from Vol. 1 No. 1 (Oct 78) to Vol. 6 No. 2 (July 83) £10. Your Computer from Vol. 1 No. 1 (June 81) to Vol. 3 No. 10 (Oct 83) £5. Phone John, Edinburgh (031) 331 2444.

ATPL's sideways ROM/RAM board, issue 4. Only a few months old, perfect condition. Comes with original fitting instructions, £35. Contact Sunindra. Tel: 01-555 9586 after 6pm.

BBC B unopened, Acorn DFS, light pen, official BBC recorder, many software titles disc/cassette, 4-pen colour printer programs, screen dump, books, worth £750 – offers? Telephone Ipswich (0473) 73203.

RH colour light pen for BBC B. As new, 6 months old, complete with manual and cassette, VGC, only £35. Tel: Jon (0305) 783810.

BBC model B with disc interface, LVL dual disc drive, 7 ROMs including View and Beebcalc. Also over 200 programs on disc, BBC data recorder and leads. Complete system £1,100 ono. Phone Canterbury (0227) 58529.

EPSON RX80F/T, hardly used – still in original packings with cable for BBC, manual, screen dumps, full box of paper – £259 ono. Also Quickshot joystick £5. Telephone Wombourn 897381.

BBC Spectra-vision Quickshot joystick with interface program – works even with keyboard only programs – still boxed, hardly used £14 + 75p p&p. Phone Richard Ross (0989) 62018.

SEIKOSHA GP100A Mk2 printer, Centronics interface. 10 months old, VGC: £175 ovno. Telephone Stickland, Market Harborough (0858) 64047 after 6pm.

WANTED for Atom. FP ROM, VIA, colour extension, tool kit ROM, Database, Wordpack, Database Forth, Diary utility pack, Word tutor. Send list and price to Cathal Mooney, 3 Mountross, New Ross, Co. Wexford.

MAGAZINES Full sets of Acorn User and The Micro User, plus six copies of A and B Computing for the BBC and Electron users. Good condition. Best offer takes. Phone Ian, Bridlington (0262) 601615.

BBC Quickshot joystick with interface program – works even with keyboard only programs – hardly used, still boxed £14 + 75p p&p. Tel: Ross (0989) 62018, ask for Richard.

GCC 13-ROM board. Only £30 inclusive. Also will pay well for any Intel 8271 FDC (working!). Phone 061-485 2848 evenings, ask for Stu.

ADE Systems text editor, malro assembler, and spy monitor, complete with manual and disc, only £40. (Doesn't work with 6502 second processor). Tel: John on Abingdon 20975, after 6pm.

WANTED BBC model B, cassette recorder, colour monitor, manuals, leads, games. Tel: Pontefract (0977) 796907.

UNWANTED gift. 'The Working Dragon 32' book. Practically new. Reason for selling – I have a Beeb! Phone 0525 381673 evenings and ask for Gareth. Asking price £3.50 including postage.

UNWANTED gift. 40 track 100k official BBC disc drive, unused. Complete £160 ono. Also two boxes Scotch discs (20) unused. £32. Frank Turley, 'Orchard Bank', Keswick Lane, Bardsey, Leeds LS17 9AG. Telephone 0937 73123.

BBC model B OS1.2, few books and stacks of original software. All leads and cables for £350 ono. Tel: 01-940 3562. Please ask for Jane.

PRINTER. Tandy TRS-80 four colour x-y plotter, 40/80 characters per line. BBC compatible, superb graphics with the two, graphic dump programs supplied in the price, £130. Iver (0753) 651417 (Slough area).

IKON floppy tape drive. Just plug in and go. Includes all leads, manual and operating chip, £85. Tel: Steve Wood, Staines 53386, weekdays after 5 pm.

WANTED. BBC B DFS drive(s) with manuals. Extras may be purchased with package. Also redundant or broken Video Genies, TRS80 models. Others to FHG, 19 Grayson Drive, Lowestoft, Suffolk NR33 7BA.

ROM extension socket. Mistake purchase so going for only £13 ono. Would cost up to £23 otherwise. Needs 21F socket (can supply). Phil Stubbington, 24 Thames Crescent, Maidenhead. Strictly no phone calls please.

BUSINESS COMPUTER. 16 bit, 8" disc drive, integral cassette, 17½" tractor printer, S100 bus, 2 consoles. Documentation available. £500 or why. Newport. Tel: Ickford 387 (Buckinghamshire).

ATARI 400 including cassette recorder and two Quickshot joysticks and lots of software £160 ono or swap for Acorn Electron. Tel: Woking 67454, after 4 pm.

FOR SALE. Shugart 40-track SS SD 100k, £100. Shugart 40-track DS DD 400k, brand new, £180 oro. Ring 051-648 4419. 21 Laurelhurst, Pensby, Wirral.

BBC B. 0.1OS. Could deliver within reasonable distance. Best offer secures. Tel: Upwey 2167 (Dorset).

WANTED. Atom Wordpack ROM. Tel: 0642 722141 extension 29. David.

MICRONET Modem 1000 plus ROM software for BBC B. New condition, still boxed, including full instructions. Bargain £50 ono. Tel: Kineston Blount 51694 (Chinnor, Oxfordshire), Mr Small, 8 Cherry Tree Road, Chinnor, Oxfordshire.

FOR SALE: BBC Basic board for Atom, £25 ono. Tel: Alan Brown 0932 47262 extension 30 daytime or 0483 578732 evenings.

BBC B 1.2OS, Wordwise, leads, condition very good, 16 months old but seldom used, £320 ono. Tons of software. Tel: 01-361 2954.

TORCH Z80 disc pack. Complete, boxed, virtually unused. Cost £840, sell £640. Also Newbrain model A, disc controller, CP/M disc, Newbas assembler, all available documentation, including software technical manual. Washington (0632) 4168041 evenings.

WANTED. Atom disc packs. Reasonable prices paid. Also non-working Atoms with new keyboard. Tel: Andy, Swindon (0793) 39736 weekday evenings and weekends.

WANTED. Atom software, particularly games pack 9 (Snapper). Tel: 01-459-3405 evenings and weekends.

ATOM BBC board MOS extension ROM. Fits BBC conversion board and gives BBC or Atom COS at 1200 or 300 baud, £10. A. McIneeney, 32 Ardilaun Road, Newcastle, Galway, Ireland.

BBC model B with desk and software. Hardly used for lack of time, £350 ono. J. Faul, 9 Ellesmere Road, Twickenham TW1 2DJ. 01-892 8275 evenings.

BBC B, 1.2, Sanyo Cassette, manuals, books, cables for sale due to delivery of Apricot. Also BBC and Gemini programs. All at £350 (current cost over £500). Ring Hugh Somers at 01-221 7221.

BBC B, 5 months old, still under guarantee, perfect condition. I can't find the time to use it. Only £340. Tel: Clifton Hampden 7146. Some software also.

WANTED. Educational software for Acorn Electron – algebra – geometry – arithmetic – for age 14-15. Tel: David Thomas (0758) 612968 any time after 4 pm.

MICROWARE. Complete DDFS upgrade kit and manual. As new, unused, untouched, £80. Jim Botten, tel: 0895 448951 after 6.30 pm.

WANTED: Acornsoft View package. Please write stating price. Steve Price, 8 Staple Close, Waterlooville, Hampshire PO7 6AH or Tel: Waterlooville 58093 (home) or Cosham 321212 ext 5437 (work).

VIC 20 16k expansion, in excellent condition with tape recorder, joystick and games – Jelly Monster (cartridge), Pack of four games, and educational tapes. Sell for only £165. Ring 01-937 1992, any time.

BBC B wanted, also additional equipment, books, software considered. London area, will collect. Tel: 01-370 0718. Evenings: 01-373 6354.

AMBER 2400 dot matrix printer. Excellent condition. Leads for Acorn Atom, paper, ink cartridge. Data sheets, instruction booklet, £60. Tel: Kevin 04024 45464 (evenings only).

WANTED. BBC B computer. Must be VGC. No software required. Tel: 01-594 1965 (London area).

PRINTER. Star DP510 complete with interface cable, original packing, 2000 sheets of paper and telex rolls. As new, £200 ono. Tel: (0506) 42659 after 6 pm.

KENDA DMFS/DOS. Double density. No user RAM used, allowing easy transfer of cassettes. No limit to number of files. CP/M filenames. Recovery of erased files and lots more, £80. Tel: Rajiv, 01-204 1908.

SEIKOSHA GP-250X graphics printer with BBC cable, screen dump program, manual, new ribbon. Excellent condition £175. Tel: Wentworth 2621.

WANTED. BBC micro disc interface, will pay up to £60. Tel: Sheringham (0263) 823936. Ask for Jonathan after 6 pm.

WANTED. Any BBC ROMs – will pay £15 ono; your old 0.1/1.0 EPROMs – will pay £5 ono; ATPL ROM board – will pay £20 ono. Tel: 08833 7495.

SWEEPER. Wanted data, plug-ins, spares for Telonic SM2000 Sweep Generator. Please ring Ralph Taylor, 0766 770637, evenings or write Bwlch Glas, Penrhyndeudraeth, Gwynedd LL48 6RU.

EXCHANGE back issues of American personal/hobby computing magazines. What have you? Smith, 84 Edenfield Gardens, Worcester Park, Surrey KT4 7DY.

JOYSTICK. Fantastic sure shot self centering joystick. Two fire buttons. As used in over 250,000 arcade machines worldwide. Sturdy construction. As new, boxed, still under guarantee, £13. Tel: (091) 336-2812 after 6 pm.

ACORN Atom 12k RAM, 8k ROM. Manuals, leads, some software. Factory serviced, good condition, £55 ono. Crook, Ongar (0277) 363615 (evenings).

ATOM 12k plus 12k, 3 books, games, plus Tandy 4-colour printer and cable, cassette recorder and lead, black and white TV. New £550, will sell £345. May sell separately. Write to D. Pearce, Powell House, Sedbergh, Cumbria (other offers are welcome).

GRAFPAD graphics tablet, brand new. Includes CAD specialist software, disc and cassette, manuals. Value £164 – will sell for £120. Morphy Encore chess computer. NICAD battery pack (rechargeable), £90 ono. Tel: 01-743 1579 (evenings).

TEAC 55A slimline disc drives. Pair, single sided 40-track 200k total, excellent units, genuine reason for sale, complete with format disc/manual. One only. £260. Offers, 0679 63611.

WANTED. Aids ROM, printer to suit BBC B. Solidisc sideways RAM board. Please telephone your price. Ask for Peter. Tel: Minehead (0643) 3969, after 6 pm.

BBC computer disc interface kit, full set of 11 chips, £95 ono. Martin, Bedford (0234) 46951.

BBC Model B, 1.2OS, Basic 2, switched mode PSU, £300. Also Hobbit with zero memory option, £70. Tel: 04026 7339 after 8 pm, Les.

BBC B with disc interface, Acorn 800k disc drives, Solidisk 32k RAM board, joysticks and vast collection of software, £900 ono. May split. Also Acorn Z80 second processor, £250. Tel: Richard, 01-340 0534.

WATFORD Electronics MK. 1 ROM socket board, with fitting instructions, for sale. First offer of £25 secures. Derek – Ruislip 31386.

TANDY colour graphics plotter, centronics (BBC compatible), serial interfaces. Complete kit, under guarantee, £95 ono. Also ZX81 – offers? Bryants, 1 The Hollies, Chalcraft Lane, Bognor Regis PO21 5SX. Tel: 829478.

ATARI VC5 with paddles and joysticks, four cartridges, £60 ono. Please ring Doncaster 531175.

TELEPRINTER and BBC interface for sale, £40. Also disc interface kit wanted, will pay or swap for Teleprinter and interface. Tel: Cardiff (0222) 620053 after 5 pm.

BBC B, DFS plus 1.2OS plus Acorn speech, £385 ono. D. A. Shugart 5¼ inch DD, £150 ono. Grundig 16" TV/Monitor, £200 ono or £700 for everything plus extras. Voltmace Delta 14b joystick, £10. Voltmace keypad adaptor box, £11. Advanced User Guide, £10. Tel: Plumtree 5143 evenings.

CUMANA CD200 dual 40-track disc drives, integral power supply with leads, formatting disc and manual. Still under warranty, £300. Leatherhead, Surrey (0372) 373740.

WANTED. Portable colour television, good working order. Price negotiable. Tel: Leyland 51720, evenings after 4 o'clock.

BBC B 1.2, Basic II, BBC DFS plus D/drive, Wordwise and Tandy CGP115 P/printer plus desk plus programs. All-in price, £500. Contact Pat, 01-330 4662 after 6.30 pm.

ATOM routine wanted to disable break key – Basic or M/C. Write to Martin Coffey, 11 Courtfield Road, Ashford, Middlesex TW15 1JN.

WANTED. BBC Model B with disc interface and possibly disc drive. Tel: (0752) 51355 after 5 pm.

BBC Model B and disc interface (ANB03), Acorn fitted DFS. Issue 7. 1.2OS. 2.0 Basic. Four weeks old, £395. Tel: evenings, 0730 (Petersfield) 64059.

WATFORD ROM board, £22.50. 32k Solidisk sideways RAM and utility discs, £35. Forth ROM and manual, £22.50. Disc-Doctor ROM, £20. All manuals etc. Want colour monitor. Tel: 0635-41571 (Newbury).

JUKI printer, three wheels, and six ribbons, £300. Tel: Gloucester (0452) 421930 after 6.30 pm.

WATFORD ROM expansion board for sale, £24. Tel: Newcastle (091) 4886132.

WANTED. Acorn BBC DFS ROM. Must be 0.98 version. Telephone price to 0342 712448, after 7 pm.

EXCHANGE Moto-Guzzi V50II 6700 mls screen and other extras. For disc and printer system, approx value £800, compatible with BBC. Tel: 029-13 2298.

BBC Model B OS1.2, plus 5 games cassettes (worth £40), plus 2 books. All mint condition, £410. Tel: (Sidcup) 302-9952 (ask for Daryl).

BBC B 1.2OS Microware DDFS Teac (800k) 40/80 D/S disk drive, MCP40 printer/plotter, cassette recorder, disks, numerous games, utilities, EPROMs, books etc, joysticks. All as new, £750. W. Sussex (0903) 762093.

WANTED for Atom. Acorn Wordpack ROM, BBC Basic board, Forth and Lisp with manuals, games packs 9/11. No extortionate prices please. Phone Mark on Thanet (0843) 582132.

EPSON M-160 5×7 matrix printer. 24 characters single or double height or width printing and graphics. Barely used. Leads and screen dump included. Plug in and go! Only £45. Tel: 0780 740363.

BBC model B one year old with Exmon, Wordwise ROMs, BBC cassette recorder, computer table, software, books: £399, no offers. Ring John 0744 819453 (Merseyside) after 8pm.

KAGA Taxan Vision 1 RGB colour monitor, complete with lead for Beeb. As new and boxed. £175. Tel: John (0432) 271589, Hereford.

BBC model B 1.2OS, absolutely unused, £350 – no offers. Write to Mr D Leach, 104 St George's Square, Pimlico, London SW1.

WANTED Utility and application ROMs from Acorn, Computer Concepts, Watford, Beebugsoft, Pace, others? Eg View, Beebcalc, Graphics, Beebfont, Toolkit, Commstar, Toolstar, Database. Tel: 0792 207258 or write to 10 Benbow Close, Sketty, Swansea SA2 8LH.

FOR SALE. Shugart dual 100k disc drives with masses of software, only £380. Prism modem 1000, brand new, only £50. Tel: 0223 829384 after 6pm.

FORTY copies Personal Computer World. Offers/Swap. Wanted joystick for Beeb. Phone David 0756 3482.

CAN you help? Does anyone know where I can get a screen dump for a BBC B to a Dolphin BD80P? If you can help contact Mr Lutak on 021-358 6384 evenings.

BEEBPLOTTER, Watford, 4 months old, never used (£69 new) only £48 including tape, manual, postage. Write to Nasser, 8 Canterbury Hill, Tyler Hill, Canterbury, Kent CT2 9LS.

TELETEXT adaptor for sale, £150. Wanted: Daisywheel or other reasonably priced printer. Phone 02576 3271.

PRINTER. Seikosha GP80A graphic printer. Ready to use with Beeb, 30cps, excellent condition. Will give masses of paper with it. Asking £120. If interested phone 01-959 1916 and ask for Andrew.

PRINTER. Line Printer VII, excellent condition. Ideal for Beeb. Takes standard paper and labels. 8-bit dot image printing – screen dump included. Phone 01-693 8434, Micronet 01-639 7653. Mat Biggs.

PRISM modem 2000: for sale with ROM software and all leads etc. 4 months old, great condition, any offers considered. Phone Jason (0495) 271353 after 4.30pm on weekdays or any time on weekends.

WANTED. BBC model B, 1.2OS plus DFS. Also disk drive. 01-670 9147 after 7pm.

PRINTER. Centronics 739 dot matrix, including BBC cable. Graphics, proportional spacing, 80 and 132 columns, friction and tractor feed, 160cps, View printer driver £200 ono. Phone 01-654 2175 evenings only.

WANTED: BBC model B. Pay up to £250, more if extras included (ROMs, monitor, cassette recorder, etc). Phone Richard on 01-249 2406.

ATOM. FP ROM, Disatom, Word Pack ROM +2 other toolboxes, VIA, printer driver. Timedata RAM card, (16–32k), plenty of software/books: it's packed full! 5V, 10A PSU. All in apple case – £125 ono. Phone Steve on 01-300 7128 (evenings).

BBC model B with Wdwse, disc interface, Cumana double disc drive, database on disc, manuals and box. £750 ono. Tel: Orpington 35784 or 01-303 9240 evenings.

ORIC 48k version, PSU, games cassettes plus software for morse tuition, QRA locator and RTTY split screen. £70. Also Mattel Intellivision console plus numerous firmware. Offers Denham (0895) 832147.

BBC model B, OS1.2, optional software and tape recorder, £350 ono. Contact: Lea Brindle, Bedford (0234) 218356 or 750111 ext 2235. Flat 1, 48 Shakespeare Road, Bedford.

SEIKOSHA GP100A graphics printer including cable for BBC, paper and graphics and text screen dump utilities for BBC. £160. Phone Chalfont St Giles (02407) 4827 evenings.

BBC model B, issue 7, 1.2OS, boxed as new with manual, welcome tape, guarantee card. Less than two months old £330 ono. Phone Erith 63841 after seven.

WANTED. P8271 – forty pounds cash waiting or Acorn or Watford OFS – pay up to £60. Phone Ken, Horley 71975 after 6pm.

WANTED. Acorn Atom computer. Tel: Worksop (0909) 721421 after 6pm.

BBC model B and Hitachi monitor for sale. 1.2OS. Good condition, £360 cash. London SW1, 01-834 0143.

BEEBPLOTTER graphics tablet for BBC B 32k, hardly used. Will draw and copy pictures in all modes. Instructions and software all included, £50. Tel: Stuart Sidders, Watford (0923) 31247.

BBC B 1.2OS, Acorn DFS, Wordwise, software worth £700, 400k double sided switchable disk drive, 34 floppies, green screen monitor. Worth £1,600 – the lot £1,055 ono. Telephone 047 283 378 after 7pm. Kevin Bramhill.

BBC model B, OS1.2, basic 2, Acorn disc interface. Official BBC disc drive 100k, some software. Offers between £250 to £350. Phone (0274) 501776.

WANTED. Compiler for BBC B. Must compile quickly and compactly. Willing to pay up to £10 for originals on tape (must include full documentation). Tel: Adrian 0705 372698.

THE MICRO PULSE 5.25" DISC DRIVES

ANNOUNCEMENT

* Northern Computers announce 6 new models of Micropulse 5.25" disc drive, manufactured and assembled in the North West, for the BBC computer.
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please contact: Gareth Littler Mark Howard or Judith Allen at Micro Pulse Division



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ACORN USER ADVERTISEMENT PAGES – SEPTEMBER ISSUE

Sorting Program Courtesy of Gemini

DISC drive for BBC micro. Single, slimline, Microware drive, double-sided, 40-track (200k). Cased, with all leads for direct connection. Only £130. Telephone Max Heath, 01-363 7175, anytime.

TWO ATARI joysticks and Bud joystick interface to analogue port. (Immediately compatible with Acornsoft games.) £17. Also Spectravideo joystick for user port, and conversion tape £7. (01) 722 7846 evenings.

BBC B 1.2OS Microvitec colour monitor, cassette recorder, joysticks; boxed and as new. Also 20+ games, manuals, 100+ magazines (including BBC/Acorn). Genuine bargain at £675. Caller collects. Telephone 0752 333479 evenings 6pm/7pm.

FINISHED with those back issues of Byte, DDJ, etc? Kilobaud/Microcomputing, 73, 68, 80 Micro, etc available to exchange. Send your list and wants to: Smith, 84 Edenfield Gardens, Worcester Park, Surrey KT4 7DY.

REGA Planar 3 turntable plus Goldring C920 IGC cartridge, £150 ono. Sir ROM board £35. Mono green monitor (BBC) £90 ono. Prestinox 35mm slide projector £30, screen £5. Intellivision cartridges £10 each. Complete computer system £900 ono. Telephone Mike on 051-933 8387, Liverpool.

TANDY CGP115 four colour printer/plotter plus £30 worth paper, pens, £115 ono. Phone Nottm 292055.

QUICKSHOT joystick plus joystick driver, good condition, £12. Telephone Nottingham 257355.

ROMs – HCCS Forth, Pace DFS, Beebase-1, £18 each. Prism acoustic modem for Prestel, £20. Quickshot joystick £10. Software included with modem and joystick. Tel (0782) 314053 after 7pm.

BBC ROMs for sale. Wordwise and Advanced Graphics ROMs. Worth over £40 each, will accept £20 each. Reason for sale: unwanted gifts. Ring 01-552 3181 after 4.30pm. Ask for Sukhjit.

TANDY CGP115 4 colour printer/plotter. Excellent condition, in box with BBC centronics lead, £100 ono. Telephone Walsall (0922) 24850.

SPEECH synthesizer for BBC computer. Cheetah Sweet Talker. Only one month old, £15. Tel: 0602 285003.

BACK issues of Kilobaud/Microcomputing, 68, 73, Micro 6502, 80 Micro, etc. SAE list. Exchanges welcomed (American magazines only). Smith, 84 Edenfield Gardens, Worcester Park, Surrey KT4 7DY.

WANTED Quickshot II Joystick. Ring (0840) 212550 from 5-6pm, ask for Simon.

BBC B 1.2OS, Acorn DFS, manual, leads, some software magazines, BBC data recorder available. £400, very good condition. Phone Appleby (Cumbria) 52358.

PRINTER Tandy CGP-115, 40-80 characters/line, in 4 colours. Also does graphics. Boxed with manual as new, £100. Tel: 0325 312417.

■ **NEW!** Edit 7 – mode 7, full feature, 10 page text and graphics editor £5. Disassembler – £3.50. Egg – the upgrade – 8 new boards, joysticks and more for Chuckkie Egg, £3.50. Cheques, POs to Crystalsoft, 8 Pepys Walk, Langney, Eastbourne, Sussex BN23 7QR.

■ **ROMboards?** Fit a ROM Extension Socket to your Beeb's keyboard instead. Use any number of ROMs. Rapid change over. Easily fitted. £19.99 inclusive. Steelappeal, Hambledon Close, Blandford, Dorset. Tel: (0258) 53742.

■ **Beams** designed to BS.449 (steel) and CP.112 (timber) for architects, engineers, builders. Printout satisfies L.A. Send large SAE to Beamscan, 20 Vaughan Avenue, Hendon, London NW4 4HU.

■ **Interface** board for BBC micro, provides 8 channel ADC, real time clock, allophone speech synthesiser, 4 I/O ports and DAC. All for £70. Send SAE + 50p for full details to VM Interface, 42 Arnham Road, Preston PR1 4QN.

■ **BBC** Image ultimate tape back-up copier. Copes with locks, files, any length, false addresses, ?'s in filename, 300 + 1200 baud. Unlocks/locks programs. 100% M/C. £3.80. P Donn, 33 Little Gaynes Lane, Upminster, Essex RM14 2JR.

■ **Super** BBC fun learning package, Resource & Builder, used in schools. Test your knowledge before you ask the children. £10 inc postage. Endless possibilities. Creative Learning Programs Ltd, 9 Silver Park Close, Aldershot GU13 0BP. Telephone: 02514 6215.

■ **Nutcrackers.** Tape 2 tape + tape 2 disc + disc 2 disc + disc 2 tape: £5. 'C40 to 80': 40 track to 80 track converter: £5. 'Rompull' + tape dump + 'tape recover': £5. R-Soft, 22 Marriott's Close, Felmersham, Beds MK43 7HD. Tel: 0234 781730.

■ **BBC Micros.** Large stock of model Bs, clearance sale £370 each all inclusive. Phone Hotline (0632) 737654. Kumar Computers, 9 Crossley Terrace, Newcastle NE4 5NY. Limited offer.

■ **Antistatic** washable dusters containing 1% stainless steel. Removes risk of disk drop outs, EPROM damage and high voltage screen static. 50p each or £4 for 10. Peter Drew (Textiles) Ltd, Canada House, Bidford-on-Avon, Warks B50 4JN.

■ **Advanced** User Guide binders. Stiff plastic backed, titled, open flat, ring binders. £3.50 inc p&p. Hepworth & Co, Waulkmill Farm, Ingersley Vale, Bollington, Cheshire SK10 5BP.

■ **INDEX** – The different database. Store any article reference or a synopsis on your favourite subject. Any length of record. Filing/search using own keywords. Details: Vicdata Software, 30 Repton Way, Rickmansworth, Herts WD3 3PW. £8.25.

■ **'Superior Mover'** Last chance! Moves Hunchback, 2002, Qbert, Roadrunner, etc automatically to disc: ready to run. £5. R-Soft, 22 Marriotts Close, Felmersham, Beds MK43 7HD. Tel: 0234 781730.

■ **BBC** unwanted software: Gemini's Cashbook £30. Software for All's Purchase/Sales Ledger £20 (each). All originals, (disk). M. Mynott, 116 Churchill Road, East Barnet, Herts.

■ **Copyking** back-up tape copier. Multiple copies from single loading. 300 + 1200 baud. Locks/unlocks. £3.50. Electron/BBC B OS1.2 – state which. T Thornham, 6 The Meadows, Walberton, W. Sussex BN18 0PB.

■ **500 Labels** £3.50, VAT/delivery included. Two across, 3½". Barrington Associates Ltd, FREEPOST, Cheadle Hulme, Cheshire SK8 7YB.

■ **I say**, I say, I say . . . anything. Interrupt driven speech synthesiser – best yet! Resident vocabulary. BBC only. Software ROM. £34.99 + 50p p&p. Cheques and POs to Metron Audio, 7 Delilah Road, Hamworthy, Poole, Dorset.

■ **Juki** 6100 daisywheel printers. New/guaranteed. £375 including VAT. Free delivery in the UK. Also 400k/800k disc drives from £189 delivered. Woking (04862) 62020, anytime.

■ **'How to'** move your s/w from tape to disk. Cassette with 9(!) utilities and extensive documentation: £5. R-Soft, 22 Marriotts Close, Felmersham, Beds MK43 7HD. Tel: 0234 781730.

■ **Printwise** adds power to Wordwise/Epson. Simple commands replace messy control codes. Also Greek (FX only), macros, autonumbering! £12.50 (disc) or SAE details. Astrosoft, 39 Latimer Way, North Pickenham PE37 9JY.

■ **Ardsoft** Educational Software announce the release of their new, quality educational software. Free catalogue and demo cassette available on request. Send 50p (p&p) to Ardsoft Educational Software, 20 Castle View, Leeds LS17 5BY.

■ **Joysticks** – top quality at amazing low price. Only £9.95 a pair. Easier to handle and faster than others costing twice as much. Cheque/PO to Peritron, 21 Woodhouse Road, London N12 9EN.

■ **Stolen** during burglary – BBC model B, unmodified, serial No. 10 – ANB01-3050166; Philips D2924 keyboard entry LW/MW/SW/VHF; Radio, LCD display, Serial No. 10288; Network NW900 cassette recorder. Reward offered: Phone 01-954 2311 ext 4325.

■ **Heartrate monitor** – BBC B. Complete hardware (built) + software cassette, displays heartbeat trace on screen + digital pulse readout, optional 'ECG' beep etc. Plugs into analogue port, detects pulse from finger held on infra-red sensor. Details included for use as a lie detector, monitoring fitness etc. Introductory price only £15.95 inc. Computer People, 30 Westholme Gardens, Ruislip, Middx.

£10 SMALL AD SERVICE

Please include your cheque for £10 made payable to Redwood Publishing. This is the standard fee. Don't forget your name, address or phone number. Send cheque plus form to Acorn User Small Ads, 68 Long Acre, London WC2E 9JH.

The old joke is on Torch

■SO, having been bought up by Acorn, Torch has now done its own thing and bought up the distribution rights to the Graduate from Data Technologies (founded by Martin Vlieland-Boddy, who set up Torch – small world isn't it?).

Well, having got the topical intro out of the way, let's get down to the joke. Here goes . . .

Imagine it's Christmas and Hermann Hauser's three lads come up to sit on dad's knee and ask for their presents.

Oldest boy: 'I want a Porsche like yours, dad.'

HH: 'Fine son, it's on the way.'

Second boy: 'Dad, can I have a Macintosh?'

HH: 'Sure son.'

Youngest boy: 'Please daddy, can I have a cowboy outfit?'

HH: 'I'll go out and get you one right now.' So Hermann pops out and buys him Torch!

■WITH the Acorn share price leaping to 193p and then diving to 120p Acorn Abuser asks: Which Acorn directors have recently taken holidays in the Bahamas?

■ACORNSOFT has added the exciting Progo to its range of languages. Progo is a cross between Prolog and Logo designed for artificially intelligent turtles.

Languages supremo Paul Finland commented: 'Progo will be available on the Electron as soon as we get the plus 5 Mouse interface.





ACORN is very proud of its record in introducing women to computing, and nowhere was this in greater evidence than at the WI Leisure Exhibition. Even the Queen came along to take a look at the stand. However, a certain hypocritical view has been noticed in the company's sponsorship of one of the most sexist of sports, motor racing. This even stretched to providing two 'dolly birds' to kiss the winners at the British heat of the F3 European championship.

Mind you, at least Acorn did turn out for the Women's Institute because, as Acorn's PR men assure us in their release, no other computer company did. Furthermore, nearly all the staff on Acorn's stand were women, taken from the education and customer services divisions.

ACORN ABUSER'S Diary

'The micro-mouse and micro-turtle communicate via own language, Smalltalk, which should be available in the third quarter.'

■A VISITOR to Acorn's London HQ in Henrietta St. recently complained his Acornsoft disc would not work. On being asked for the disc, the customer removed his wallet and extracted a floppy disc, which was carefully folded into four!

When told it couldn't be replaced he replied: 'But I was told a floppy disc was flexible.'

■B&G Software has developed the ultimate in protection devices for the company's new cassettes. It's so secure that not even their tape duplicators can break it.

■*A&B* quote '. . . launch of Data Technologies' IBM PC compatible upgrade for the model B. The Cambridge hothouse continues to produce revolutionary products to support the BBC and this one is particularly well branded as the 'Graduate'.

Not a bad writeup considering the UdderGraduate is DT's first product.

■ALL these rumours about a new Acorn DFS! Our very own disc controller Orson Fact interviewed Hugeo Thighsson, the man who gave us 0.90 and then emigrated.

HT: 'In the beginning there was 0.90. Then I created the 57 internal varieties resulting in 1.2 for the second processors.

'There is no such thing called the ADFS – it doesn't exist – and it certainly won't be released this year. No it isn't compatible with the Watford DFS.'

Hugeo has recently been replaced by Australian Bruce Cowboil, who shot to prominence in Rooland for causing the great Fosters drought of 1982.

■ACORN International MD Bob Mayhem has reacted angrily to allegations of selling lethal Exocet local area networks to Argentina. Roving *Acorn* reporter Orson Fact was passing through Brazilia when he saw a shipment of Level II Flyswatters on its way to Buenos Aries (codenamed Aries B20 in the Falklands war).

When quizzed as to the fighting potential of the Flyswatters Mayhem retorted: 'They are completely harmless without the DNFS 3.0 arming device. Vector sent those to Iraq.'

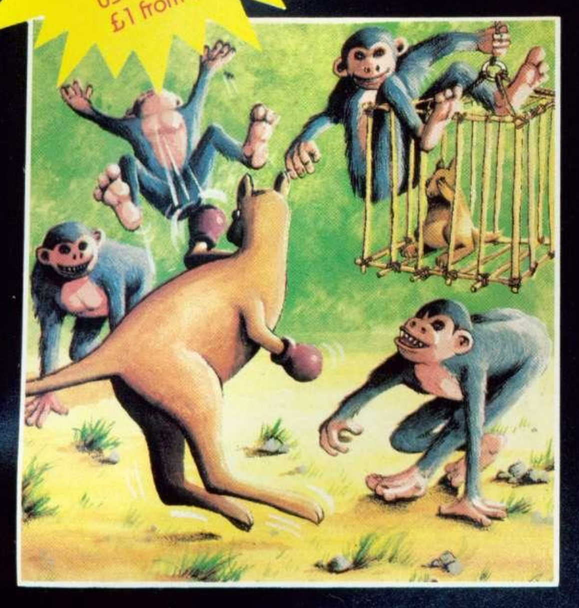
```
10 MODE2:VDU23;8202;0;0;0;
20 *FX9,4
30 *FX10,4
40 VDU23,224,255,255,255,255,255,255,255,255
50 COLOUR130:CLS
60 VDU23,225,0,127,64,127,96,63,32,63
70 VDU23,226,0,254,2,254,2,252,4,252
80 VDU23,227,128,255,128,128,255,128,128,255
90 PROCQL(500,500)
100 VDU4:COLOUR0
110 PRINTTAB(3,2);"Ever wanted to"''TAB(3);"blow up a QL ?"
120 PRINTTAB(5,28);"HIT SPACE..."
130 REPEATUNTILGET=32
140 GCOL0,1:MOVE50,200:DRAW600,480:MOVE1200,200:DRAW600,480
150 FORT=1TO200:NEXT
160 CLS:SOUND0,-15,7,50
170 FORX%=1TO80
180 R=RND(2)
190 IF R=1 GCOL0,12 ELSE GCOL0,14
200 MOVE550,500:DRAWRND(1280),RND(1000)
210 GCOL0,0:PLOT69,RND(1280),RND(1000)
220 NEXT
230 PRINTTAB(2,5):"TOUGH LUCK CLIVE!"
240 FORT=1TO4000:NEXT
250 RUN
260 DEFPROCQL(X%,Y%)
270 VDU5:GCOL0,8:MOVEX%,Y%:PRINTSTRING$(3,CHR$224)
280 GCOL0,15:MOVEX%,Y%:VDU225,226,227
290 VDU4:ENDPROC
```

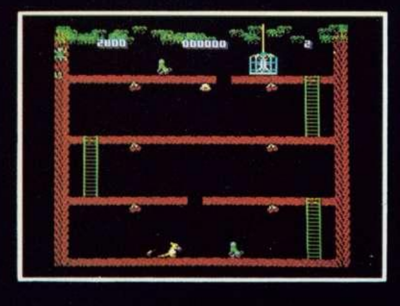
Bit of a silly one this. The idea of the game is to blat the QL – and all you have to do is press the space bar. As the authors, Richard Batt and George Martin, admit, the program is of little educational value, but they did put it together at the end of a computer studies lesson. Other readers have only to send in their entries and, who knows, they too might win one of our coveted software prizes.

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NEW RELEASES













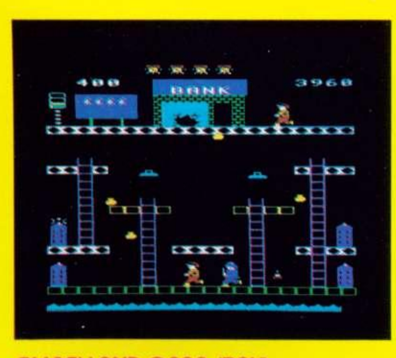
WALLABY (32K) £7.95

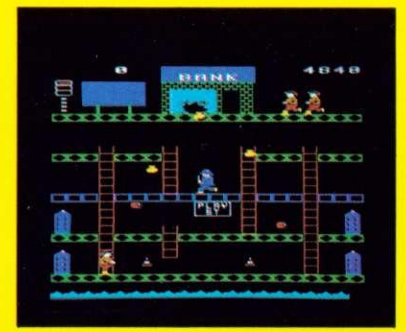
From the author of Overdrive comes another superb arcade-action game. You must guide Wally the Boxing Wallaby up the ladders to rescue the baby wallaby from its cage. The evil monkeys will try to stop Wally in his tracks; he can kill the monkeys by a swift upper-cut, but watch out for the apple-cores which they hurl at him without compassion. Five screens of increasing difficulty with bonus fruit on each level. Yet another winner from Superior Software!

●●●NEW RELEASE●●●



Many of our titles are available in Boots, W.H. Smiths, John Menzies, Rumbelows, Laskys, Currys, HMV, Greens at Debenhams and Spectrum Shops. Also at all major computer dealers — Eltec Computers, Micro Management, West Coast Personal Computers, Microstyle, Electronequip, 3D Computers, Computerama, GTM Computers, etc. Our software is also available through all the major distributors, and directly from us by mail-order.



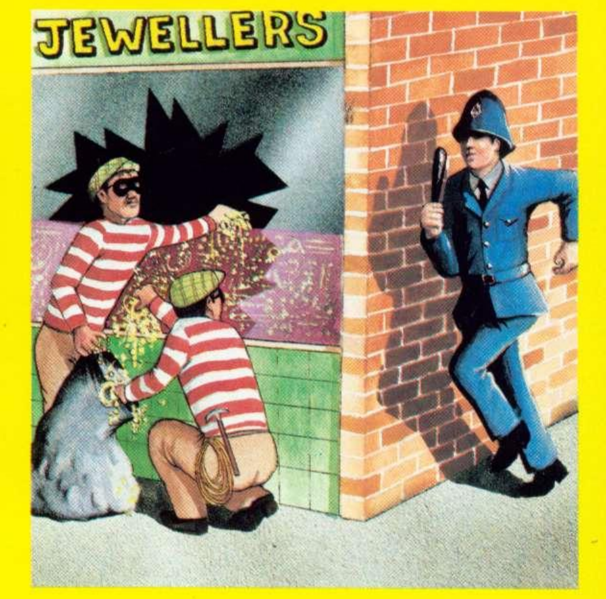


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(KEYBOARD OR JOYSTICKS)

●●●NEW RELEASE●●●



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